Farming the Land of Hatti:

A Socio-Economic History of Agriculture in Central Anatolia from the Bronze Age to the Hellenistic Period

by

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DEDICATION

To my parents,
Sandra and Luigi

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None of my achievements would have been possible without my loved ones: my parents, my grandparents, my brothers, my sister, my dearest friends. This work is dedicated to you.

ABSTRACT

The aim of this dissertation is to provide a multidisciplinary and diachronic reconstruction of Anatolian agricultural systems, focusing on the period from the Early Bronze Age (3000 BCE) to the incorporation of Asia Minor under Roman rule (1st century BCE/CE).

This project is built upon a survey of the available primary sources, including archaeological data, archaeobotanical evidence, paleoenvironmental sequences, textual accounts, and ethnographic records. Evidence from literature is complemented by an extensive original archaeobotanical (wood charcoal and seed/fruit remains) and archaeological dataset from the site of Niğde-Kınık Höyük (Turkey), which has been obtained in the framework of the dissertation project. The volume is organized in three parts, as briefly summarized below.

Part I, *Agriculture in Pre-Roman Central Anatolia: Contexts, Sources, and Questions*. This part of the dissertation is composed by two chapters. In Chapter 1, I provide a general introduction to the historical and environmental contexts covered by the project. The specificities of the Anatolian physical geography are discussed, and the regional socio-cultural and historical trajectory is outlined. Chapter 2 is a literature survey of the available primary sources informing on ancient Anatolian agriculture. After a methodological introduction to each specific field, the published archaeobotanical, palynological, and textual sources are critically reviewed.

Part II, *The Agricultural Landscape of the Ancient Tyanitis* (*Southern Cappadocia*) *in the Late 2nd and 1st Millennia BCE: Archaeological and Archaeobotanical Evidence from Niğde-Kınık Höyük*. The second part of the dissertation is based upon original archaeological and archaeobotanical research I have conducted at the site of Niğde-Kınık Höyük, in southern Cappadocia (Turkey). This extensive original dataset allows to reconstruct the history of the southern Cappadocian agricultural landscape, from the late 2nd to the end of the 1st millennia BCE. In Chapter 3, I provide a general introduction to the physical geography, history, and archaeology of the study region, the historical *Tyanitis*. Chapter 4 concentrates on the large-scale granaries brought to light at Niğde-Kınık Höyük, which are radiocarbon

dated to the 10th century BCE. Already in the early 1st millennium BCE, agricultural production appears to have represented a pivotal aspect of the local political economy, which hints to the presence of a surplus-oriented centralized agriculture. The evidence of large-scale storage from Kınık Höyük is discussed in relation to the regional and supraregional political and economic history. In Chapter 5 and Chapter 6, I present and discuss the results of the archaeobotanical study conducted on samples from Kınık Höyük, respectively on wood charcoal (Chapter 5) and seed/fruit remains (Chapter 6). The evidence collected indicates a progressive expansion of the cultivation of water-demanding crops throughout the 1st millennium BCE, peaking in the Achaemenid and Hellenistic period. Viticulture and arboriculture appear, in particular, to have represented a cultural and economic hallmark of this thriving agricultural landscape.

Part III, *Agriculture in Pre-Roman Central Anatolia: from the Emergence of Complex Societies to the Beginning of Roman Rule*. In the final part of the volume, I provide a diachronic reconstruction of Anatolian agricultural systems, which is based on the published and original evidence outlined in the previous chapters. In this multidisciplinary narrative, the regional agricultural history is discussed in connection to the local environmental setting, paleoclimate, and socio-cultural and political history. The picture that emerges is characterized by a high degree of local complexity and specialization in agropastoral economies. In this part of the dissertation, among several other topics, I discuss the role played by agriculture in the formative processes of the Hittite polity, the degree of continuity and discontinuity in agricultural systems across the Late Bronze Age and Iron Age transition, and the flourishing of viticulture and arboriculture during the 1st millennium BCE.

The dissertation aims to provide a reference work on the history of agriculture in Asia Minor, targeting a multidisciplinary readership. The Anatolian trajectory is discussed in a supraregional framework, engaging with central debates in Eastern Mediterranean and Western Asia history and archaeology.

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INTRODUCTION

Why a history of agriculture?
Why central Anatolia?

The aim of this dissertation is to provide a multidisciplinary and diachronic reconstruction of central Anatolian agriculture, focusing on the period from the Early Bronze Age (3000 BCE) to the incorporation of Asia Minor under Roman rule (1st century BCE/CE).

In *La Méditerranée et le Monde Méditerranéen à l'Epoque de Philippe II* (1949), Ferdinand Braudel showed how the Mediterranean Sea is not a mere background for human dramas, but a participating and engaging actor in the complex play of Mediterranean history. With this dissertation, I intend to apply a similar understanding to the study of Anatolian history, looking at the Anatolian Plateau as constitutive acting element in the regional historical trajectory. In these terms, the study of ancient agriculture could represent a privileged field of inquiry.

Agropastoral activities are located at the interface between natural and cultural phenomena, directly impacted by the climatic and environmental milieu on the one hand, and technological know-how and socio-economic organization on the other. The study of ancient agriculture could, thus, directly illuminate how climate and environment factored in the ecology of past socio-cultural systems. To which extent agricultural systems are subordinated to the specific local and regional environmental settings? Which infrastructural, agronomic, and institutional means can allow for their expansion? How changes in climate and environment impacted agricultural production? And which agricultural strategies can polities, communities, and individuals adopt in order to mitigate the impact of these changes? In light of the specific climatic and environmental setting, which is paralleled by an eventful regional socio-cultural and political history, the Anatolian Plateau represents a unique and privileged context where to develop these research questions.

Where? Agriculture in central Anatolia

Central Anatolia is a high plateau located at the center of a peninsula surrounded by steep mountain chains and protruding into the Mediterranean Sea. This complex physical geography has direct repercussions on the regional climate: the winter Mediterranean storms are partially blocked by a combination of localized high-pressure systems and orographic effect, determining semi-arid climatic conditions. In the traditional Anatolian farming system, based on the cultivation of rain-fed winter crops, the amount and distribution of rainfall occurring from October to March is a crucial variable in determining both the success of the harvest and the yield: harvest failure or significantly lower yields are to be expected if those rains do not occur, if their onset is delayed, or if they occur in values lower than average. Anatolian farmers are, thus, well-familiar with agricultural droughts occurring at relatively regular intervals, which – if not adequately confronted – could result in famines. Early modern accounts provide vivid descriptions of the economic and social consequence of these catastrophic events:

> *"Before the sowing season came, the seed was eaten and the oxen died. Less than one-fourth of the usual area has been sown, and what has been sown will not give a good yield, so that the harvest will bring scarcely any relief. Even the vines and fruit trees have been damage by late frosts and hail, and will not yield*

their usual quota of subsistence to the population. Last year there was some old grain in store. This year is none. All the resources of food have been consumed and the harvest is wholly inadequate to supply the population. Taking the most moderate estimates of the deaths from actual starvation and the diseases resulting from insufficient food, they cannot fall short of 150,000. …" (Levant Herald – July 29, 1874; Ertem 2012: 77).

Ancient agriculture was no exception to these concerns, and ancient Anatolia farmers were likewise well-aware of the unpredictability in agricultural production, chiefly due to climatic instability. To quote a literary topos attested in the Anatolian hieroglyphic Iron Age corpus: "*much came down from the sky, and much came up from the earth*" (e.g., SULTANHAN; Hawkins 2000: 466). In light of these considerations, the physical geography of central Anatolia has been traditionally regarded as a challenging and limiting factor to the development of a stable and productive agriculture, a consideration holding far-reaching implications for the interpretation of the regional socio-economic and political trajectory.

When? From the onset of social complexity to the Roman Empire.

In the dissertation project, I will cover the period comprised between the onset of social complexity (Early Bronze Age; ca. 3000-2000 BCE) and the incorporation of central Anatolia under the Roman Empire (1st century CE). This long-term perspective allows to diachronically discuss Anatolian agriculture in connection with the regional and supraregional socio-cultural and political history.

In Anatolian archaeology, the Early Bronze Age (ca. 3000-2000 BCE) is traditionally associated with the onset of social complexity. The accumulation of wealth in form of luxury goods, most notably metals, is regarded as one of the main sources of power of these newly established Anatolian elites. These dynamics are contrasted to the (earlier) processes leading to social complexity in the Mesopotamia alluvium, in which the control of agricultural production and products is regarded as a pivotal aspect (e.g., Frangipane 2018). Which was, thus, the role of agricultural production at this early stage in Anatolian history?

The Middle Bronze Age (ca. 2000-1600 BCE) saw the establishment of a well-structured long-distance trade network on the Anatolian Plateau, involving local elites and Assyrian merchants. The latter traders exported to Anatolia bulk quantities of tin (from central Asia) and textiles (from Babylonia and Assur), which were exchanged for local silver (e.g., Larsen 2015). In which way this trading network, and the associated economic structures, impacted agricultural production and management?

From the constellation of city-states characteristic of Middle Bronze Age Anatolia, the Hittite Kingdom emerged in the 17th century BCE as regional and supraregional power. Evidence accumulated in the past two decades suggests that staple products had a central role in the Hittite political economy, in apparent discontinuity to the earlier historical phases (e.g., Schachner 2022). Which role agricultural production played in both the establishment and collapse of the Hittite Empire? How the Hittite polity succeeded in overcoming the productive limits imposed by the Anatolian plateau?

The collapse of the Hittite Empire (ca. 1180 BCE) opened to a major phase of reconfiguration in economic and political structures within and beyond the Anatolian Plateau. Different regional trajectories emerged, with a degree of regional fragmentation representing a hallmark of the Iron Age (ca. 1180-550 BCE) (e.g., d'Alfonso 2020). Where these changes involving also Agricultural production? Did the Hittite agricultural system survive the fall of the Empire?

The latest phase covered by the project corresponds to the Achaemenid (ca. 550-330 BCE) and Hellenistic (ca. 330-1 BCE) periods. The second half of the 1st millennium BCE, in central Anatolia is characterized by the presence of a significant degree of external influences (Persian and Aegean), which is, nevertheless, coupled with the presence of an enduring local Anatolian tradition (e.g., Panichi 2017). Which agricultural landscapes are associated with these processes? Are new crops introduced as result of those external cultural influences?

How? Sources on ancient Agriculture.

The study of ancient agriculture requires a multidisciplinary approach. This dissertation will be accordingly based on four main sets of evidence: (*i*) archaeological evidence, with a particular attention given to agricultural infrastructure (e.g., granaries and water management); (*ii*) archaeobotanical records, with emphasis on botanical macro-remains from archaeological sites (wood charcoal and seeds/fruits); (*iii*) Paleoenvironmental archives, and in particular pollen sequences from off-site deposits; and (*iv*) textual sources which, either directly or indirectly, inform on ancient agriculture.

In addition to a systematic survey of published sources, the evidence from literature is complemented by an extensive archaeobotanical (wood charcoal and seed/fruit remains) and archaeological dataset from the site of Niğde-Kınık Höyük (southern Cappadocia, Turkey). This evidence represents the original contribution of this dissertation project, which originated from field and lab work I have conducted between 2015 and 2021.

Dissertation structure

Part I, Agriculture in pre-Roman Central Anatolia: contexts, sources, and questions. This part of the dissertation is composed by two chapters. In Chapter 1, I provide a general introduction to the historical and environmental contexts covered by the project. The specificities of the Anatolian physical geography are discussed, and the regional socio-cultural and historical trajectory is outlined. Chapter 2 is a literature survey of the available primary sources informing on ancient Anatolian agriculture. After a methodological introduction to each specific field, the published archaeobotanical, palynological, and textual sources are critically reviewed.

Part II, The agricultural landscape of the ancient Tyanitis (southern Cappadocia) in the late 2nd and 1st millennia BCE. The second part of the dissertation is based upon original archaeological and archaeobotanical research I have conducted at the site of Niğde-Kınık Höyük, in southern Cappadocia (Turkey). This extensive original dataset allows to reconstruct the history of the southern Cappadocian agricultural landscape, from the late 2nd to the end of the 1st millennia BCE. In Chapter 3, I provide a general introduction to the physical geography, history, and archaeology of the study region, the historical Tyanitis. Chapter 4 concentrates on large-scale granaries brought to light at Niğde-Kınık Höyük, which are radiocarbon dated to the 10th century BCE. Already in the early 1st millennium BCE, agricultural production appears to have represented a pivotal aspect of the local political economy, which hints to the presence of a surplus-oriented centralized agriculture. The evidence of large-scale storage from Kınık Höyük is discussed in relation to the regional and supraregional political and economic history. In Chapter 5 and Chapter 6, I present and discuss the results of the archaeobotanical study conducted on samples from Kınık Höyük, respectively on wood charcoal (Chapter 5) and seed/fruit remains (Chapter 6). The evidence collected indicates a progressive expansion of the cultivation of water-demanding crops throughout the 1st millennium BCE, peaking in the Achaemenid and Hellenistic period. Viticulture and arboriculture appear, in particular, to have represented a cultural and economic hallmark of this thriving agricultural landscape.

Part III, Agriculture in pre-Roman central Anatolia. In the final part of the volume (Chapter 7), I provide a diachronic reconstruction of the Anatolian agricultural systems, which is based on the published and original evidence outlined in the previous chapters. In this multidisciplinary narrative, the regional agricultural history is discussed in connection to the local environmental setting, paleoclimate, and socio-cultural and political history. The picture that emerges is characterized by a high degree of local complexity and specialization in agropastoral economies. In this part of the dissertation, among several other topics, I discuss the role played by agriculture in the formative processes of the Hittite polity, the degree of continuity and discontinuity in agricultural systems across the Late Bronze Age and Iron Age transition, and the flourishing of viticulture and arboriculture during the 1st millennium BCE.

A note on plant taxonomy

Throughout this dissertation, the plant taxonomy follows the Flora of Turkey (Davis 1965-1985). The nomenclature here used is, thus, to some degree obsolete in current plant systematics. The decision to follow this traditional taxonomy is grounded in its standard use in Anatolian archaeobotanical literature.

PART I

Agriculture in pre-Roman central Anatolia: Contexts, Sources, and Questions

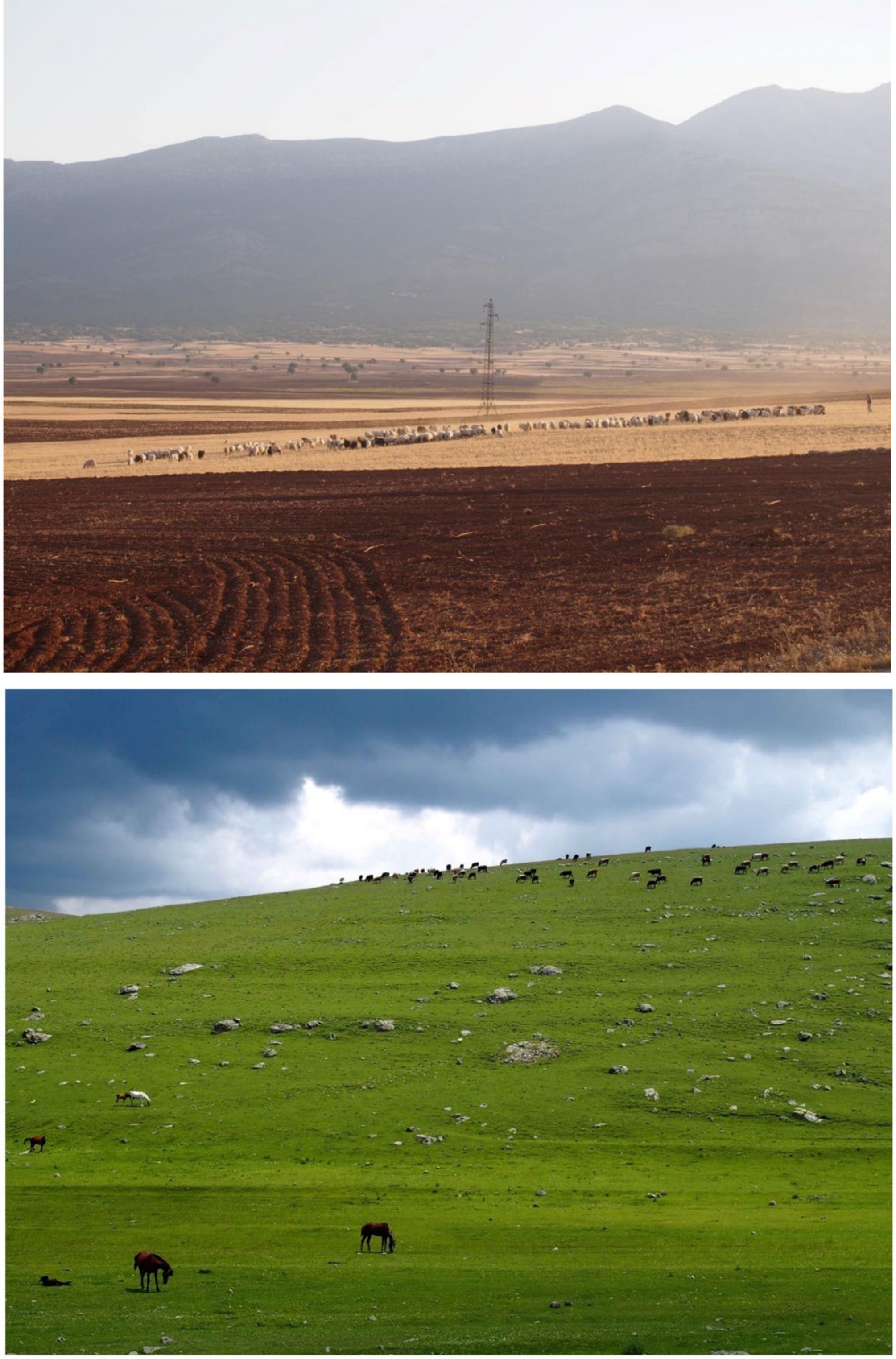


Figure I.1 – *above: Konya Plain in the late Summer, near Karaman; below: pastures in eastern Anatolia, in the vicinity of Kars.*

CHAPTER 1

The Anatolian Plateau: environmental and historical context

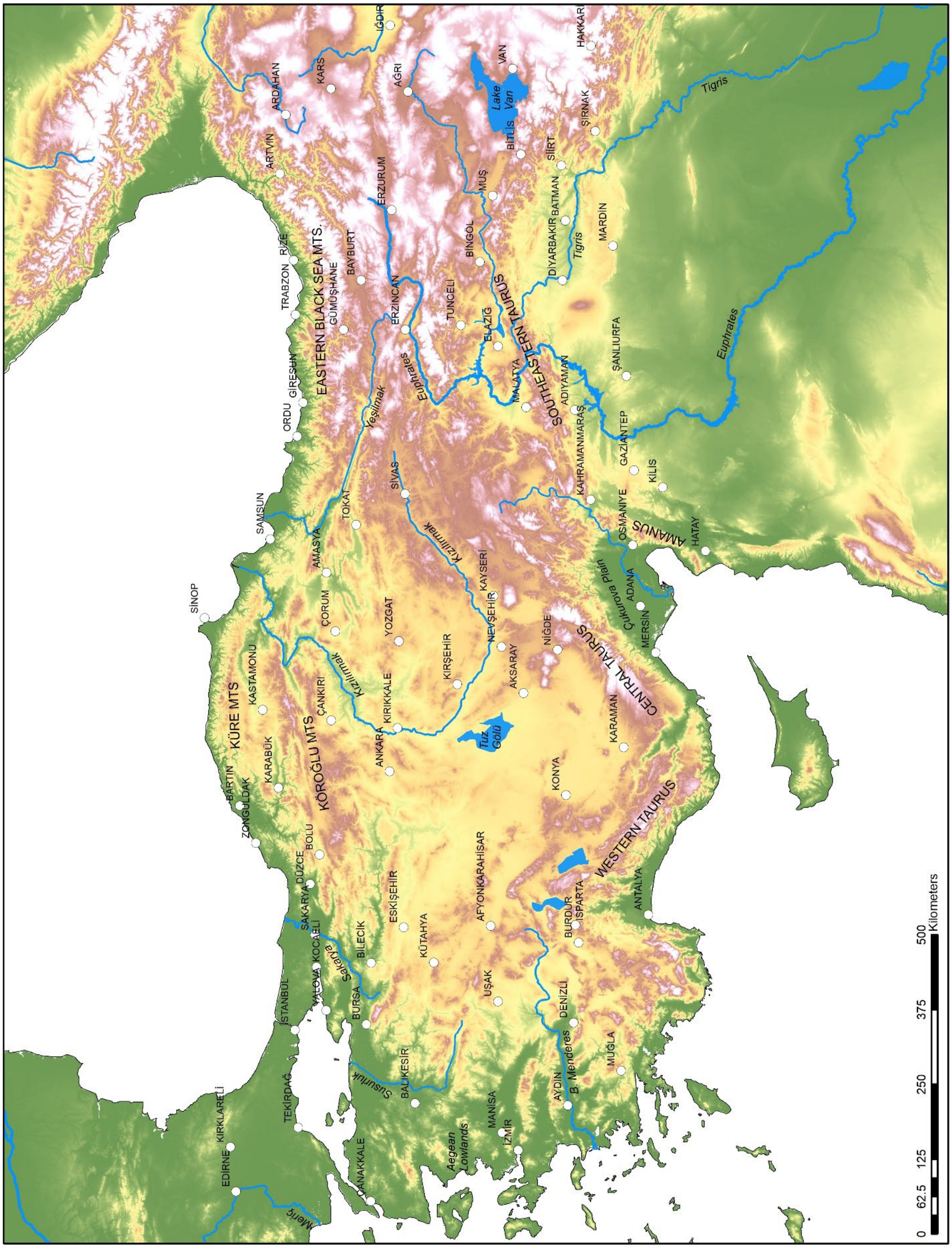
Central Anatolia is characterized by the presence of a mosaic of dynamic ecosystems and landscapes. This ecological fragmentation is coupled by an equally fluid socio-political trajectory. Before moving any further in discussing the specific topic of ancient agriculture in Asia Minor, I thus feel that it is useful to provide a general introduction to the regional physical geography (Section 1.1) and historical-archeological (Section 2.2) contexts covered by the dissertation project.

1.1 The physical geography of the Anatolian Peninsula

Central Anatolia is a high plateau, surrounded by steep mountain chains and located at the center of a peninsula, which protrudes into the Mediterranean Sea. This unique topography underlies the regional climate, hydrography, and vegetation (Kuzucuoğlu et al. 2019).

On three sides, the Anatolian Peninsula is bordered by seas: the Black (*Karadeniz*) to the north, the Aegean (*Ege Deniz*) to the west, and the Mediterranean (*Akdeniz*) to the south. The coastal regions are fringed by narrow plains, which extend seaward at the mouth of the main rivers, as a result of delta progradation. To the north and the south, steep mountain chains rise at a short distance from the coast: the Taurus Mountains to the south (*Toros Dağları*) and the Pontus Chain to the north (*Kuzey Anadolu Dağları*). Within the core of the peninsula, elevations progressively increase eastward, culminating in the rugged mountainous landscape characteristic of the easternmost regions of Anatolia (Figure 1.1).

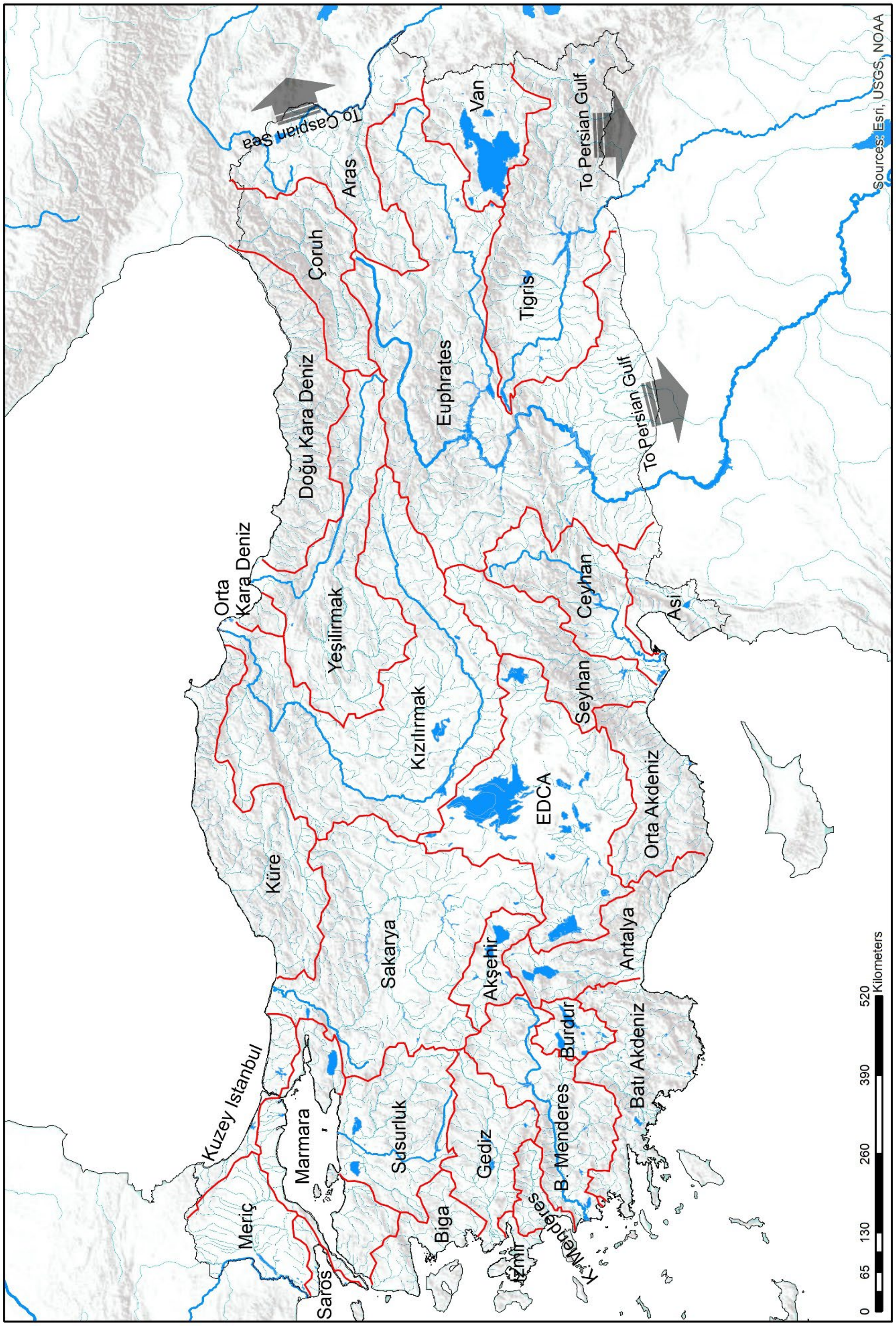
(Next page) Figure 1.1 – *Physical map of Anatolia. Figure created in ArcGIS using the ALOS30m Global Digital Surface Model* (*Tadono et al. 2014*)*. Turkish administrative districts are located.*


EASTERN BLACK SEA MTS.
SOUTHEASTERN TAURUS
CENTRAL TAURUS
WESTERN TAURUS
AMANUS
KÜRE MTS
KÖROĞLU MTS
Çukurova Plain
Aegean Lowlands
Lake Van
Tuz Gölü
Tigris
Euphrates
Yeşilırmak
Kızılırmak
Sakarya
Susurluk
B. Menderes
Meriç
IĞDIR
KARS
ARDAHAN
AĞRI
VAN
HAKKARİ
ŞIRNAK
SİİRT
BİTLİS
MUŞ
ARTVİN
ERZURUM
RİZE
TRABZON
GÜMÜŞHANE
BAYBURT
ERZİNCAN
BİNGÖL
BATMAN
DİYARBAKIR
MARDİN
TUNCELİ
ELAZIĞ
MALATYA
ADIYAMAN
ŞANLIURFA
GİRESUN
ORDU
KAHRAMANMARAŞ
GAZİANTEP
KİLİS
OSMANİYE
HATAY
SAMSUN
TOKAT
SİVAS
AMASYA
ÇORUM
YOZGAT
KAYSERİ
ADANA
MERSİN
SİNOP
NEVŞEHİR
NİĞDE
KIRŞEHİR
AKSARAY
KASTAMONU
ÇANKIRI
KIRIKKALE
ANKARA
KARAMAN
KONYA
BARTIN
KARABÜK
ZONGULDAK
BOLU
DÜZCE
SAKARYA
KOCAELİ
YALOVA
İSTANBUL
BİLECİK
ESKİŞEHİR
AFYONKARAHİSAR
ISPARTA
BURDUR
ANTALYA
KÜTAHYA
BURSA
UŞAK
DENİZLİ
TEKİRDAĞ
BALIKESİR
MUĞLA
KIRKLARELİ
EDİRNE
ÇANAKKALE
MANİSA
İZMİR
AYDIN
0
62.5
125
250
375
500
Kilometers

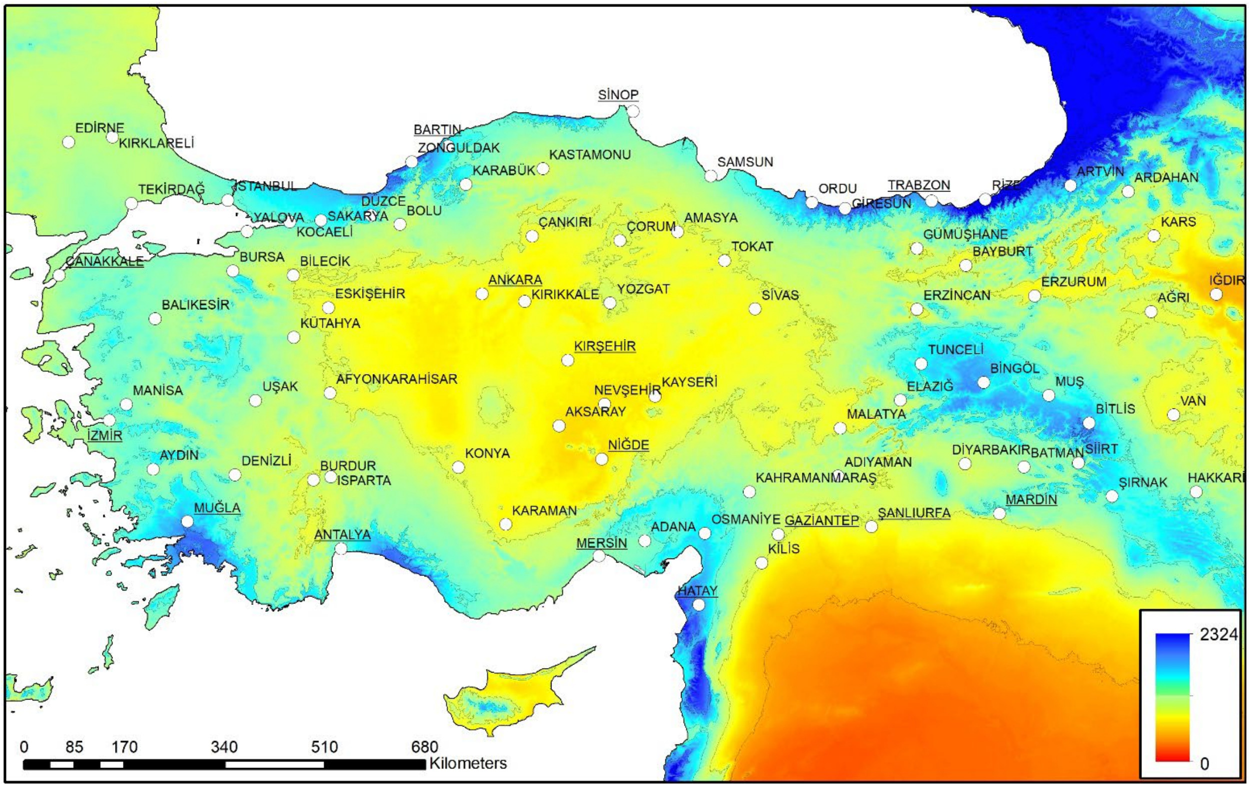
Rising at the center of different climatic regimes, the Anatolian Peninsula functions as a 'water tower' for the surrounding regions (Kuzucuoğlu et al. 2019: 3). The hydrographic basins of Anatolia drain into five different seas: the Black, the Aegean, the Mediterranean, the Persian Gulf, and the Caspian (Figure 1.2). The Kızılırmak (Greek *Halys*, Hittite *Marassantiya*), the Yeşilırmak (Greek *Iris*), and the Sakarya (Greek *Sangarios*) rivers flow into the Black Sea. A sequence of smaller basins drain western Anatolia into the Aegean Sea, including the Büyük Menderes (*Maiandros* in Greek sources), which reaches the sea in proximity of Miletus. On the southern coast of the peninsula, the steep slopes of the Taurus Mountains define the presence of shorter rivers, which drain into the Mediterranean Sea. An exception are the larger basins of the Seyhan (Greek *Saros*) and the Ceyhan (Greek *Pyramus*), which stretch from central and eastern Anatolia to the Çukurova Plain. In Eastern Anatolia, three exogenous hydrographic basins are present: the Euphrates (Turkish *Firat*) and Tigris (Turkish *Dicle*), which flow into the Persian Gulf; and the Aras (Greek *Araxes*), which drains into the Caspian Sea.

A large portion of the Anatolia Plateau is without any outflow to a sea, determining the presence of an endorheic district stretching over most of southcentral Anatolia – i.e., the Konia, the Tuz Göl basins, and large portions of Cappadocia and of the Pisidian Lake District (Figure 1.2). This hydrographic setting underlies the formation of terminal lakes and a variety of humid ecosystems, including the Tuz Göl (Greek *Tatta*), a large hypersaline playa lake. The largest Anatolian lake is Van Gölü, a terminal soda lake located in the Eastern Highlands, the presence of which is associated with a second region of endorheism within Anatolia (Figure 1.2).

(Next page) Figure 1.2 – *Hydrographic layout of the Anatolian Peninsula. The red lines indicates the limits of the hydrographic basins, based on* Eken et al. 2006*. EDCA = Endorheic District Central Anatolia.*


Meriç
Saros
Kuzey Istanbul
Marmara
Biga
Susurluk
Gediz
İzmir
K. Menderes
B. Menderes
Batı Akdeniz
Burdur
Akşehir
Sakarya
Küre
Antalya
Orta Akdeniz
EDCA
Kızılırmak
Yeşilırmak
Orta Kara Deniz
Seyhan
Ceyhan
Asi
Doğu Kara Deniz
Euphrates
Tigris
Çoruh
Aras
Van
To Caspian Sea
To Persian Gulf
To Persian Gulf
0
65
130
260
390
520
Kilometers
Sources: Esri, USGS, NOAA

The complex physical geography of the Anatolian Peninsula has direct implications on defining the regional climate zonation. Proximity to seacoast and elevation are the two main factors that underlie differences in both rainfall and temperature (Türkeş 2003). The southern and western regions experience a Mediterranean climate – defined by mild, wet winters and moderately dry, hot summers. The northern coast, which is under the influence of humidity tracks from the Black Sea, is characterized by Oceanic conditions – with wet, mild-to-cold winters and wet, warm summers. Due to orographic effects and localized winter high-pressure systems, significantly lower amounts of rainfall reach central Anatolia, which result in a continental, semi-arid climate. The distribution of precipitation in central Anatolia mirrors the typical Mediterranean seasonality, with the main exception of a relatively higher contribution of spring rains to the annual total (Figure 1.3 and 1.4).


SİNOP
BARTIN
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İSTANBUL
ORDU
TRABZON
RİZE
ARTVİN
ARDAHAN
GİRESUN
DÜZCE
BOLU
YALOVA
SAKARYA
KOCAELİ
ÇANKIRI
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AMASYA
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KIRŞEHİR
TUNCELİ
BİNGÖL
AFYONKARAHİSAR
NEVŞEHİR
KAYSERİ
MUŞ
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ELAZIĞ
MANİSA
AKSARAY
MALATYA
VAN
BİTLİS
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NİĞDE
AYDIN
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ADIYAMAN
DİYARBAKIR
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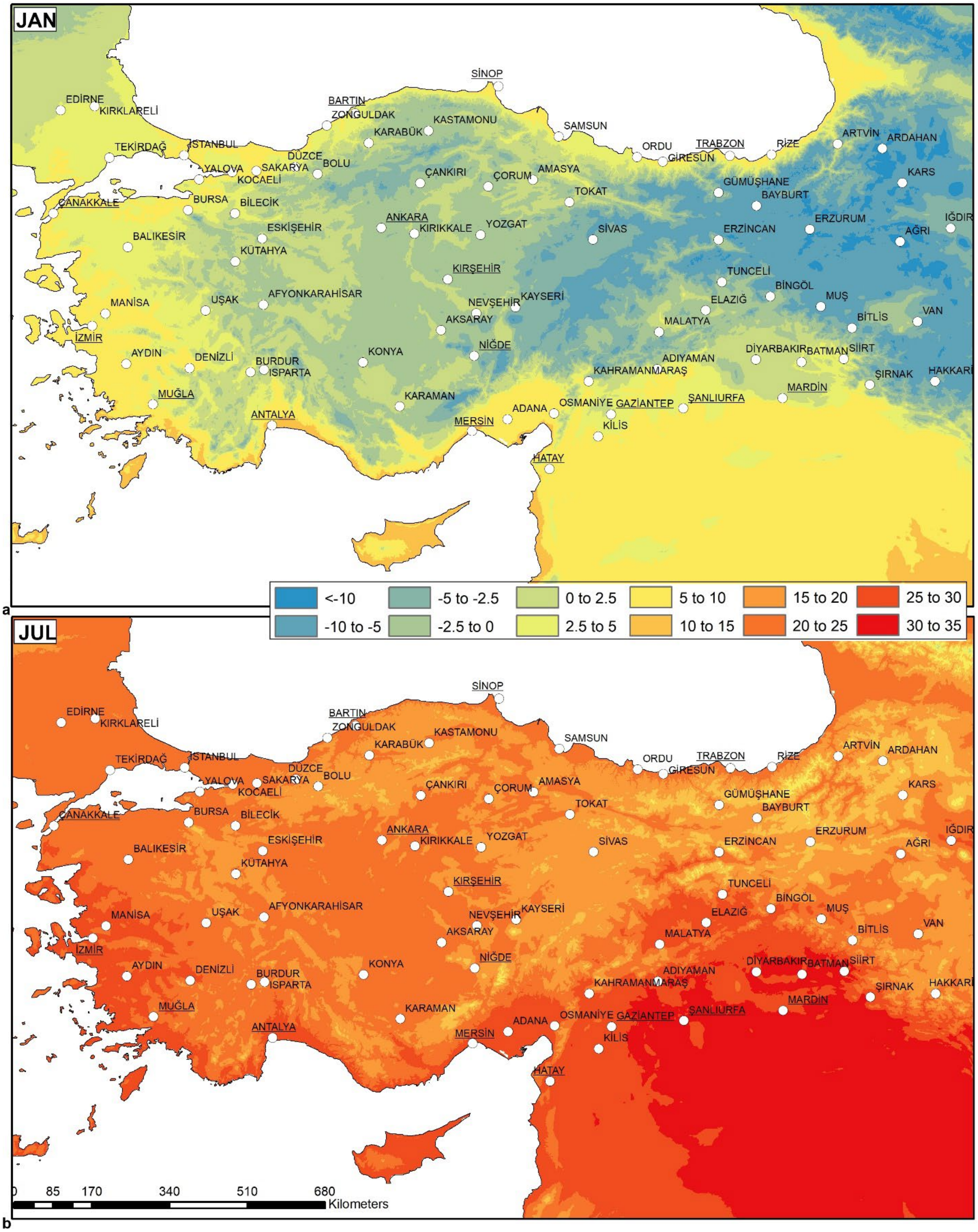
KAHRAMANMARAŞ
ŞIRNAK
HAKKARİ
MARDİN
MUĞLA
KARAMAN
ŞANLIURFA
OSMANİYE
GAZİANTEP
ADANA
ANTALYA
MERSİN
KİLİS
HATAY
2324
0
0
85
170
340
510
680
Kilometers

Figure 1.3 – *Annual precipitation (mm) across Anatolia. Figure created in ArcGis using values from WorlClim2 (1970-2000 average), 30-seconds spatial resolution (Fick and Hijmans 2017).*


JAN
a
JUL
b
<-10
-10 to -5
-5 to -2.5
-2.5 to 0
0 to 2.5
2.5 to 5
5 to 10
10 to 15
15 to 20
20 to 25
25 to 30
30 to 35
0 85 170 340 510 680
Kilometers
SİNOP
EDİRNE
KIRKLARELİ
BARTIN
ZONGULDAK
KASTAMONU
KARABÜK
SAMSUN
TEKİRDAĞ
İSTANBUL
DÜZCE
BOLU
YALOVA
SAKARYA
KOCAELİ
ORDU
TRABZON
GİRESUN
RİZE
ARTVİN
ARDAHAN
ÇANKIRI
ÇORUM
AMASYA
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GÜMÜŞHANE
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KIRIKKALE
YOZGAT
ESKİŞEHİR
SİVAS
ERZİNCAN
ERZURUM
IĞDIR
AĞRI
BALIKESİR
KÜTAHYA
KIRŞEHİR
TUNCELİ
BİNGÖL
MANİSA
UŞAK
AFYONKARAHİSAR
NEVŞEHİR
KAYSERİ
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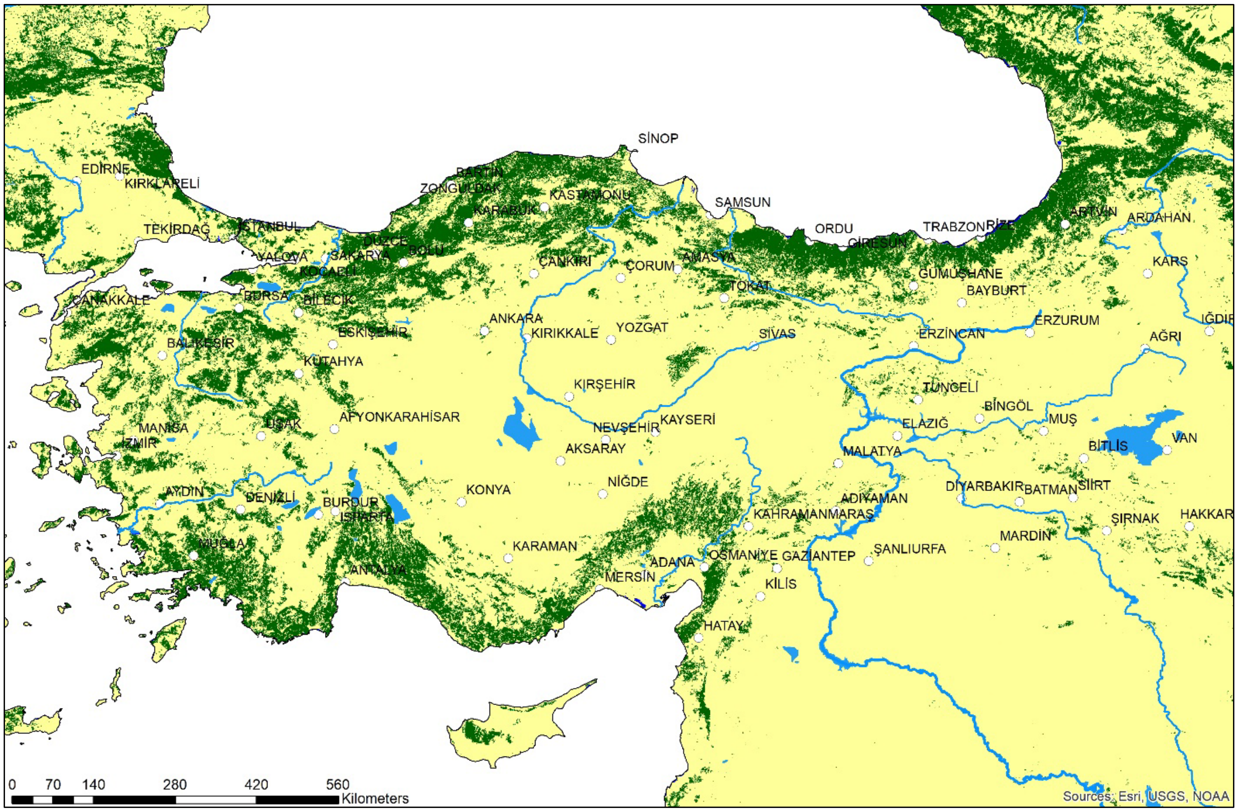
MUĞLA
KARAMAN
ADANA
OSMANİYE
GAZİANTEP
ŞANLIURFA
MARDİN
ANTALYA
MERSİN
KİLİS
HATAY

Figure 1.4 – *Average January (a) and July (b) temperatures (°C) across Anatolia. Figure created in ArcGis using values from WorlClim2 (1970-2000 average), 30-seconds spatial resolution (*Fick and Hijmans 2017*).*

Differences in climate, geology, topography, and pedology promote a distinctive phytogeography (Figure 1.6). The monumental work of Davis (1965-1985) represents the essential bibliographic starting point on Anatolian vegetation. The latter will soon be complemented by the ongoing *Resimli Türkiye Florası* project. Further information at a regional scale are provide by Zohary (1973) and Atalay (e.g., 2018). Approximately the 27% of modern Turkey is forested (Atalay 2018: 15). Woodlands are to a large extent located on the mountain ranges surrounding the central Anatolian Plateau (Figure 1.5). The plateau is conversely occupied by steppe, with the presence of relict forests limited to the slopes of the inner reliefs. Long-term anthropic pressure, especially in the form of firewood exploitation and overgrazing, has considerably impacted both the extension and the distribution of forest cover (Çolak and Rotherham 2006).


SİNOP
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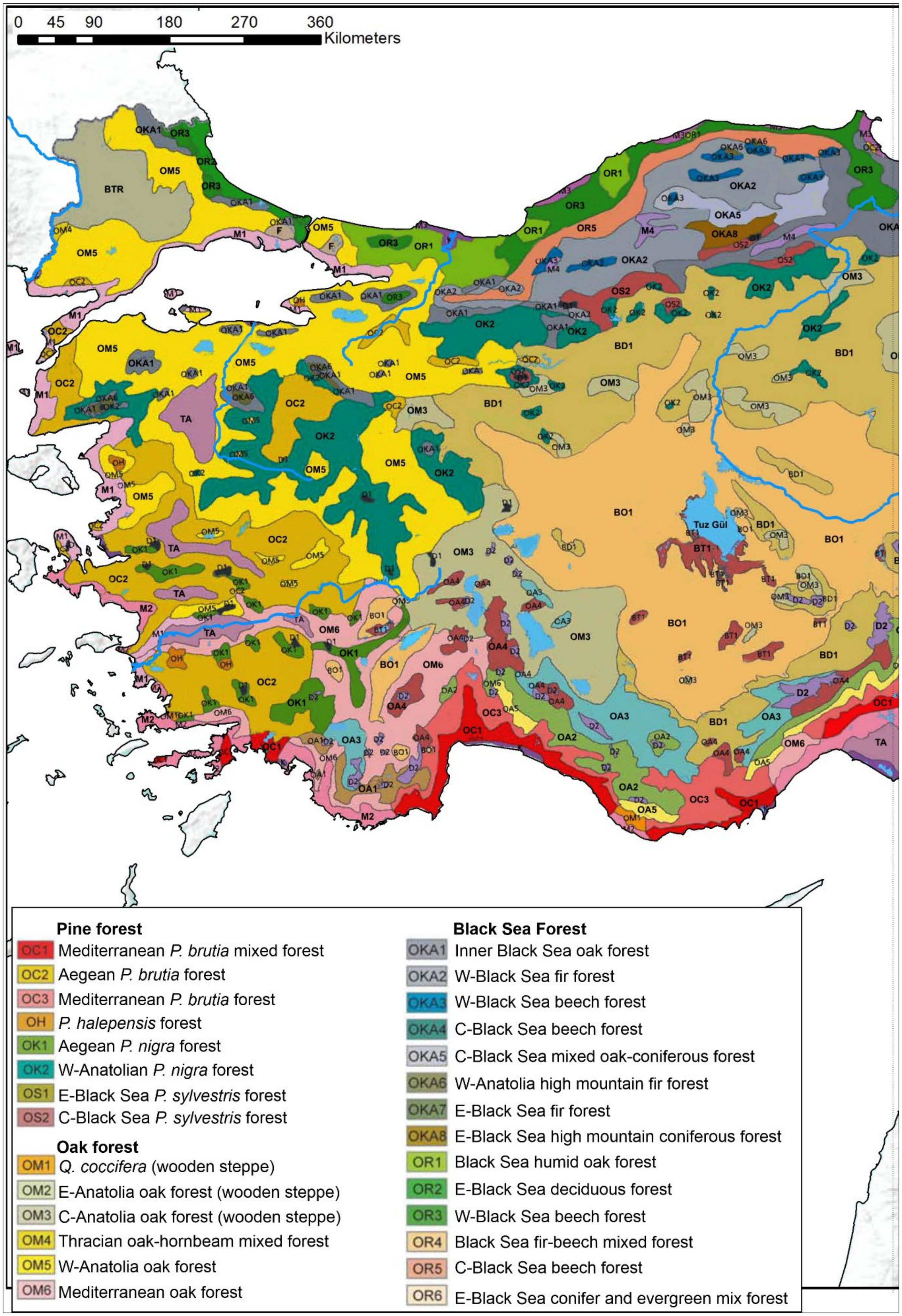
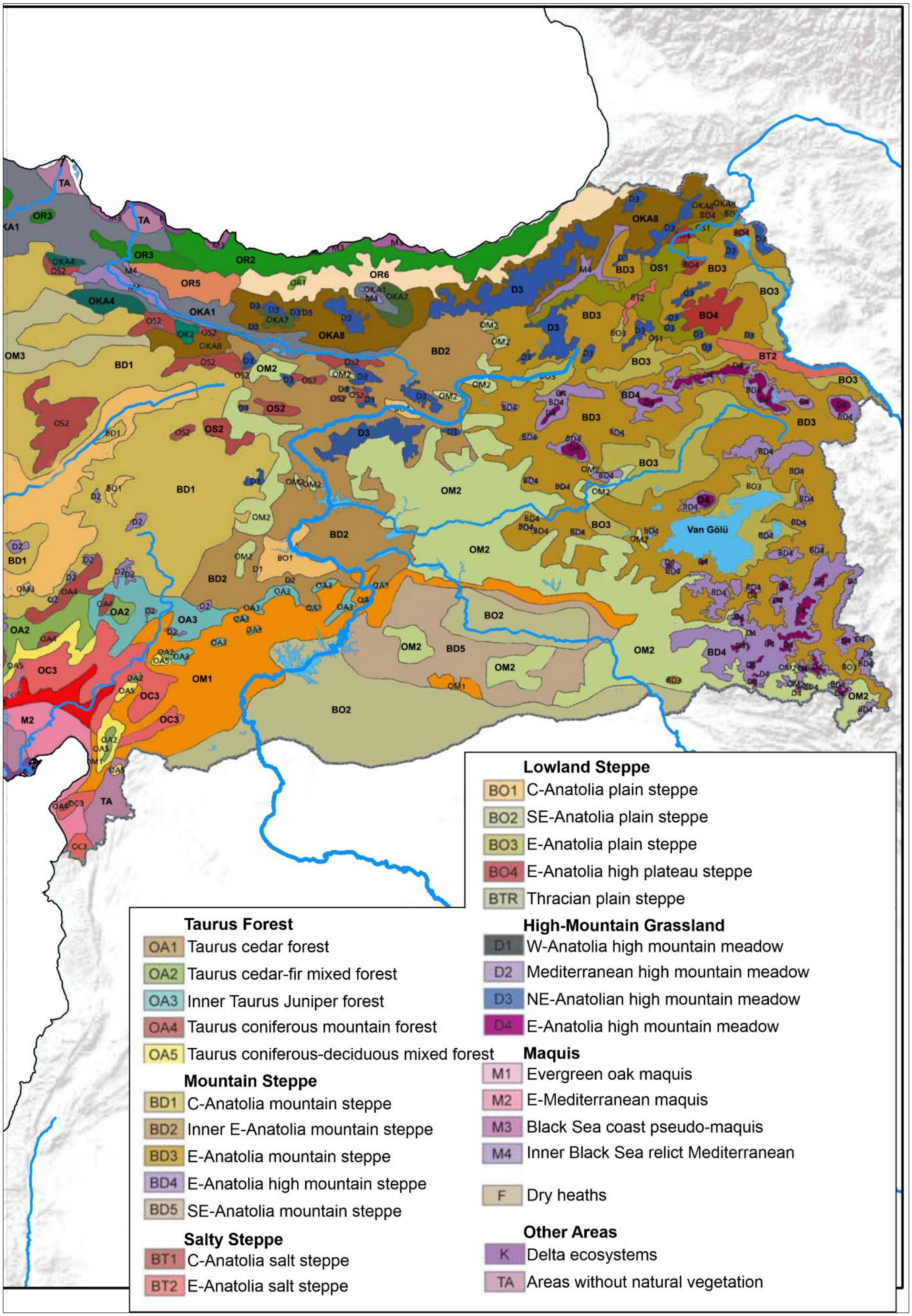
SAMSUN
TEKİRDAĞ
İSTANBUL
DÜZCE
BOLU
ORDU
TRABZON
RİZE
ARTVİN
ARDAHAN
GİRESUN
YALOVA
SAKARYA
KOCAELİ
ÇANKIRI
ÇORUM
AMASYA
GÜMÜŞHANE
KARS
BAYBURT
TOKAT
ÇANAKKALE
BURSA
BİLECİK
ERZURUM
IĞDI
ANKARA
KIRIKKALE
YOZGAT
SİVAS
ERZİNCAN
AĞRI
BALIKESİR
ESKİŞEHİR
KÜTAHYA
TUNCELİ
KIRŞEHİR
BİNGÖL
MUŞ
AFYONKARAHİSAR
KAYSERİ
ELAZIĞ
MANİSA
UŞAK
NEVŞEHİR
VAN
İZMİR
AKSARAY
MALATYA
BİTLİS
AYDIN
DENİZLİ
BURDUR
ISPARTA
KONYA
NİĞDE
ADIYAMAN
DİYARBAKIR
BATMAN
SİİRT
KAHRAMANMARAŞ
ŞIRNAK
HAKKAR
MUĞLA
KARAMAN
ADANA
OSMANİYE
GAZİANTEP
ŞANLIURFA
MARDİN
ANTALYA
MERSİN
KİLİS
HATAY
0 70 140 280 420 560
Kilometers
Sources: Esri, USGS, NOAA

Figure 1.5 – *Forest/Non-Forest land cover. Figure created in ArcGis using the Global PALSAR-2 forest cover dataset* (*Shimada et al. 2014*).


0 45 90 180 270 360
Kilometers
BTR
Tuz Gül
TA
OM5
OC2
OK2
BD1
BO1
BT1
OM3
OKA2
OA3
OC1
OC3
Pine forest
OC1 Mediterranean P. brutia mixed forest
OC2 Aegean P. brutia forest
OC3 Mediterranean P. brutia forest
OH P. halepensis forest
OK1 Aegean P. nigra forest
OK2 W-Anatolian P. nigra forest
OS1 E-Black Sea P. sylvestris forest
OS2 C-Black Sea P. sylvestris forest
Oak forest
OM1 Q. coccifera (wooden steppe)
OM2 E-Anatolia oak forest (wooden steppe)
OM3 C-Anatolia oak forest (wooden steppe)
OM4 Thracian oak-hornbeam mixed forest
OM5 W-Anatolia oak forest
OM6 Mediterranean oak forest
Black Sea Forest
OKA1 Inner Black Sea oak forest
OKA2 W-Black Sea fir forest
OKA3 W-Black Sea beech forest
OKA4 C-Black Sea beech forest
OKA5 C-Black Sea mixed oak-coniferous forest
OKA6 W-Anatolia high mountain fir forest
OKA7 E-Black Sea fir forest
OKA8 E-Black Sea high mountain coniferous forest
OR1 Black Sea humid oak forest
OR2 E-Black Sea deciduous forest
OR3 W-Black Sea beech forest
OR4 Black Sea fir-beech mixed forest
OR5 C-Black Sea beech forest
OR6 E-Black Sea conifer and evergreen mix forest


Van Gölü
Lowland Steppe
BO1 C-Anatolia plain steppe
BO2 SE-Anatolia plain steppe
BO3 E-Anatolia plain steppe
BO4 E-Anatolia high plateau steppe
BTR Thracian plain steppe
High-Mountain Grassland
D1 W-Anatolia high mountain meadow
D2 Mediterranean high mountain meadow
D3 NE-Anatolian high mountain meadow
D4 E-Anatolia high mountain meadow
Maquis
M1 Evergreen oak maquis
M2 E-Mediterranean maquis
M3 Black Sea coast pseudo-maquis
M4 Inner Black Sea relict Mediterranean
F Dry heaths
Other Areas
K Delta ecosystems
TA Areas without natural vegetation
Taurus Forest
OA1 Taurus cedar forest
OA2 Taurus cedar-fir mixed forest
OA3 Inner Taurus Juniper forest
OA4 Taurus coniferous mountain forest
OA5 Taurus coniferous-deciduous mixed forest
Mountain Steppe
BD1 C-Anatolia mountain steppe
BD2 Inner E-Anatolia mountain steppe
BD3 E-Anatolia mountain steppe
BD4 E-Anatolia high mountain steppe
BD5 SE-Anatolia mountain steppe
Salty Steppe
BT1 C-Anatolia salt steppe
BT2 E-Anatolia salt steppe

(Previous pages) Figure 1.6 – *Vegetation map of Anatolia, after* Eken et al. 2006.

On the basis of climate, vegetation, and geomorphology, the Anatolian Peninsula could be divided into eight ecological macro-regions, namely: Black Sea, Marmara Transitional, Aegean, Mediterranean, Mediterranean Transitional, Central Anatolia, Eastern Anatolia, Southeastern Anatolia (Figure 1.7). The specific boundaries between these different regions are somewhat arbitrary (Kuzucuoğlu 2019: 8).

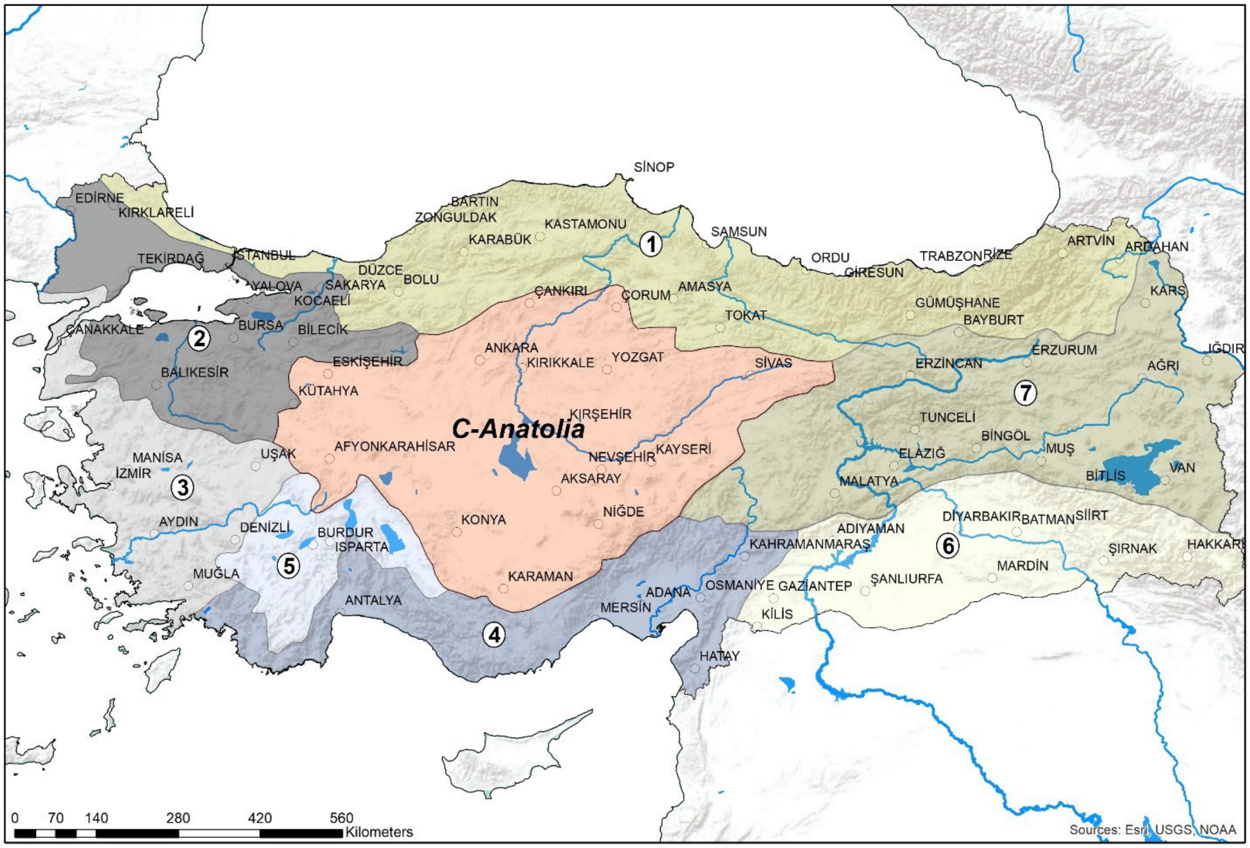

SİNOP
BARTIN
ZONGULDAK
KASTAMONU
KARABÜK
1
SAMSUN
EDİRNE
KIRKLARELİ
TEKİRDAĞ
İSTANBUL
DÜZCE
BOLU
YALOVA
SAKARYA
KOCAELİ
ÇANKIRI
ÇORUM
AMASYA
ORDU
GİRESUN
TRABZON
RİZE
ARTVİN
ARDAHAN
KARS
GÜMÜŞHANE
BAYBURT
TOKAT
ÇANAKKALE
2
BURSA
BİLECİK
ESKİŞEHİR
ANKARA
KIRIKKALE
YOZGAT
SİVAS
ERZİNCAN
ERZURUM
AĞRI
IĞDIR
BALIKESİR
KÜTAHYA
7
TUNCELİ
KIRŞEHİR
C-Anatolia
BİNGÖL
MUŞ
AFYONKARAHİSAR
UŞAK
MANİSA
İZMİR
NEVŞEHİR
KAYSERİ
ELAZIĞ
VAN
BİTLİS
AKSARAY
MALATYA
3
NİĞDE
AYDIN
DENİZLİ
BURDUR
ISPARTA
KONYA
ADIYAMAN
DİYARBAKIR
BATMAN
SİİRT
KAHRAMANMARAŞ
6
ŞIRNAK
HAKKAR
MUĞLA
5
MARDİN
KARAMAN
ADANA
OSMANİYE
GAZİANTEP
ŞANLIURFA
ANTALYA
MERSİN
KİLİS
4
HATAY
0 70 140 280 420 560
Kilometers
Sources: Esri, USGS, NOAA

Figure 1.7 – *Anatolian Eco-Regions: 1= Black Sea, 2= Marmara Transitional, 3=Aegean, 4= Mediterranean, 5= Mediterranean Transitional, 6= Southeastern Anatolia, 7= Eastern Anatolia.*

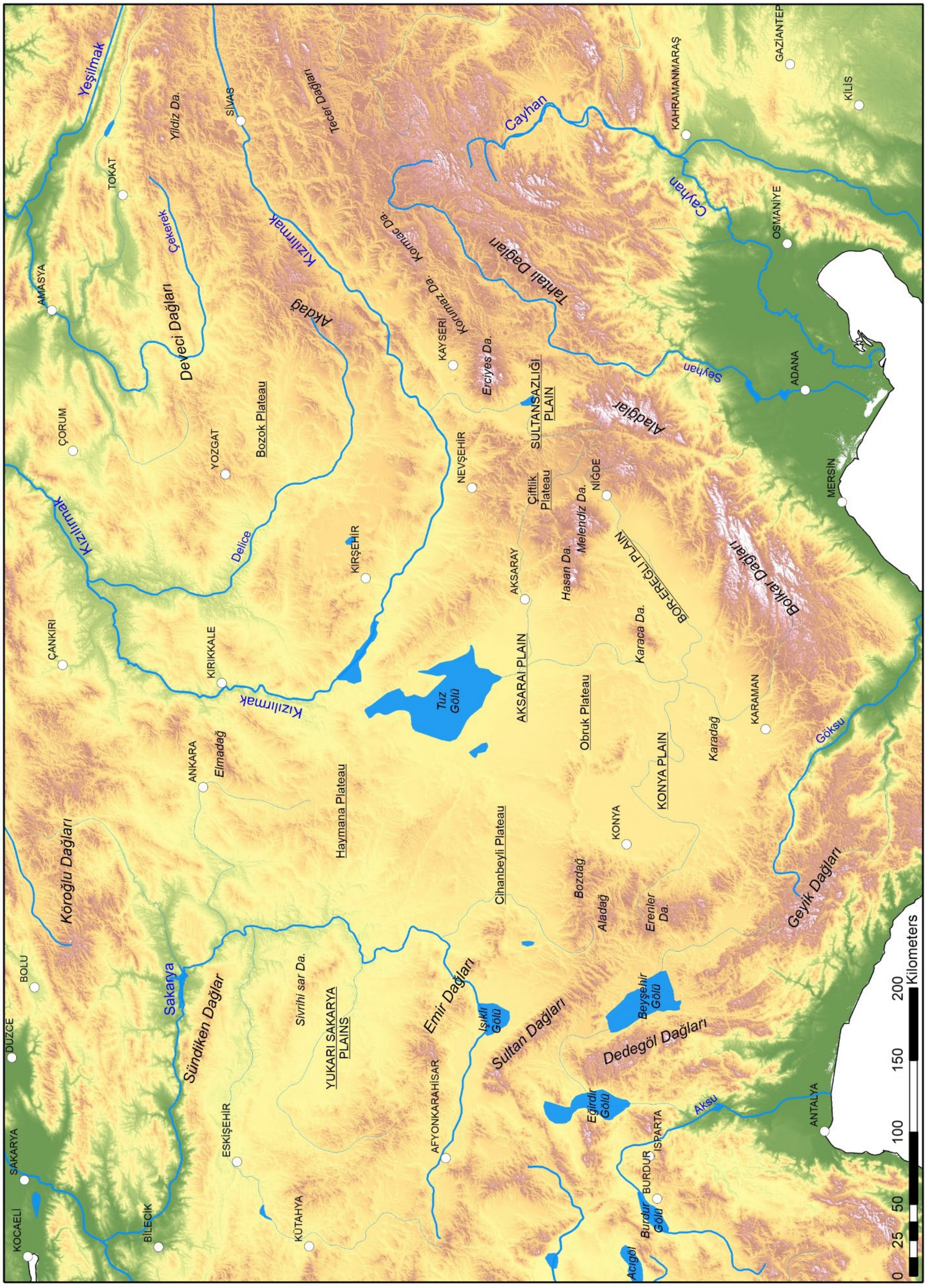
1.1.1 Physical geography of central Anatolian

The central Anatolia Plateau is defined to the north by the Inner Pontus Range and to the south by the northern slopes of the Taurus Mountains. To the east central Anatolia gradually merges with the eastern highlands. The eastern border of central Anatolia is, thus, somehow blurred (Kuzucuoğlu et al. 2019: 89-94). This region is generally referred as a ‘plateau’. Accordingly, throughout the dissertation, I will use this label as synonym for central Anatolia. The actual topography is, however, much more varied, with lowlands and a rugged relief rather than a proper plateau (Figure 1.8).

To the south, the northern slopes of the Western (Geyik Dağları) and Central Taurus (Bolkar Dağları and Aladğlar) mountains define a sharp limit of central Anatolia. The Taurus chain rises abruptly, forming a continuous and steep range. This natural barrier is crossed by two main passages: the Göksu Valley and the Çakıt Çayı (the ‘Cilican Gates’), which open respectively to the west and east of the Bolkar Dağları.

Three lowlands stretch to the north of the Taurus slopes: the Konya-Karaman, Bor-Ereğli, and Sultansazlığı Plains. The elevation of these lowlands increases as one moves eastward, from ca. 1000 m asl in the Konya Plain to 1100 m asl in the Sultansazlığı Plain (Figure 1.8). The orography in the southern portion of central Anatolia is mostly determined by volcanic landforms, which include the Melendiz massif (3268 m asl), and the two stratovolcanoes of the Hasandağı (3253 m asl) and the Erciyes (3917 m asl). The Çiftlik Plateau (ca. 1300 m asl) is located to the northeast of the Meleniz Mountains, while to the north of the Konya Plain, the low rising Obruk Plateau (ca, 1085 m asl) defines the watershed between the Konya and the Tuz Gölü Basin (Figure 1.8).

(Next page) Figure 1.8 – *Physical map of Central Anatolia. Figure created in ArcGIS using the ALOS30m Global Digital Surface Model* (*Tadono et al. 2014*).


Yeşilmak
SİVAS
Tecer Dağları
Yildiz Da.
TOKAT
Çekerek
Kizilirmak
Kormac Da.
AMASYA
Deveci Dağları
Akdağ
Koramaz Da.
Tahtali Dağları
Cayhan
KAHRAMANMARAŞ
GAZİANTEP
KİLİS
Cayhan
OSMANİYE
KAYSERİ
Erciyes Da.
SULTANSAZLIĞI PLAIN
Seyhan
ADANA
Aladağlar
ÇORUM
YOZGAT
Bozok Plateau
NEVŞEHİR
Çiftlik Plateau
NİĞDE
Melendiz Da.
MERSİN
Bolkar Dağları
BOR-EREĞLİ PLAIN
Hasan Da.
AKSARAY
KIRŞEHİR
Delice
Kizilirmak
ÇANKIRI
KIRIKKALE
Kizilirmak
Tuz Gölü
AKSARAI PLAIN
Karaca Da.
Obruk Plateau
KARAMAN
Karadağ
Göksu
ANKARA
Elmadağ
Haymana Plateau
KONYA PLAIN
KONYA
Cihanbeyli Plateau
Köroğlu Dağları
Bozdağ
Aladağ
Erenler Da.
Geyik Dağları
BOLU
Sakarya
Sündiken Dağlar
Sivrihi sar Da.
YUKARI SAKARYA PLAINS
Emir Dağları
Işikli Gölü
Beyşehir Gölü
Sultan Dağları
Dedegöl Dağları
DÜZCE
ESKİŞEHİR
AFYONKARAHİSAR
Eğirdir Gölü
Aksu
ISPARTA
ANTALYA
SAKARYA
BURDUR
Burdur Gölü
Acigöl
KÜTAHYA
BİLECİK
KOCAELİ
0 25 50 100 150 200
Kilometers

The Tuz Gölü (known in Greek sources as Lake *Tatta*) is a large and shallow (up to 1 m) playa lake located at the center of Anatolia, the formation of which is due to the local endorheism. Due to the negative hydrographic budget and high rates of evapotranspiration, this lake is extremely saline, with extensive salt alluvial flats to its southeast and northwest. As already noted, the Tuz Gölü basin is part of a broader endorheic district extending over most of southcentral Anatolia, which includes other hydrographic basins – e.g., Konya and Bor-Ereğli. This hydrographic setting underlies the formation of wet environments, including both shallow terminal lakes and a variety of marshlands, at the lowest elevations. Due to the high evapotranspiration these latter environments are often highly saline. In contrast to the southcentral district, the northern and western sectors of central Anatolia drain to the sea, through the Kızılırmak (northeast) and the Sakarya (northwest) river basins (Figure 1.2). The latter are the only two rivers that cut through the mountain ranges crowning central Anatolia. After crossing the Pontus range, both the Kızılırmak and the Sakarya flow into the Black Sea (Figure 1.8). The northern limit of central Anatolia is less abrupt than the southern, with a rugged landscape that merges with the southern slopes of the Inner Pontus Mountain range (Figure 1.8).

Compared to the coastal regions, significantly lower amounts of rainfall reach central Anatolia due to a combination of orographic effect (rain shadow) imposed by the Taurus and Pontus chains and localized winter high-pressure systems – both factors causing a partial block of the winter Mediterranean storms (Türkeş 2003). The resulting climate is cold semi-arid, with an average rainfall in the lowlands of central Anatolia comprising between 280 and 400 mm/year. A well-expressed altitudinal precipitation gradient is, however, present: significantly wetter conditions occur at higher elevations on the mountain slopes, reaching average annual values up to 600 mm (e.g., Figure 3.5). The seasonal distribution of precipitation overall mirrors a Mediterranean regime, with the main exception of a general lower amount in the yearly precipitation and a relative higher contribution of early spring rains to the annual total. The concomitance of low precipitation, almost absent for the months of July and August, and high temperatures determines the presence of recurrent meteorological droughts during the hot season (Figure 1.9).

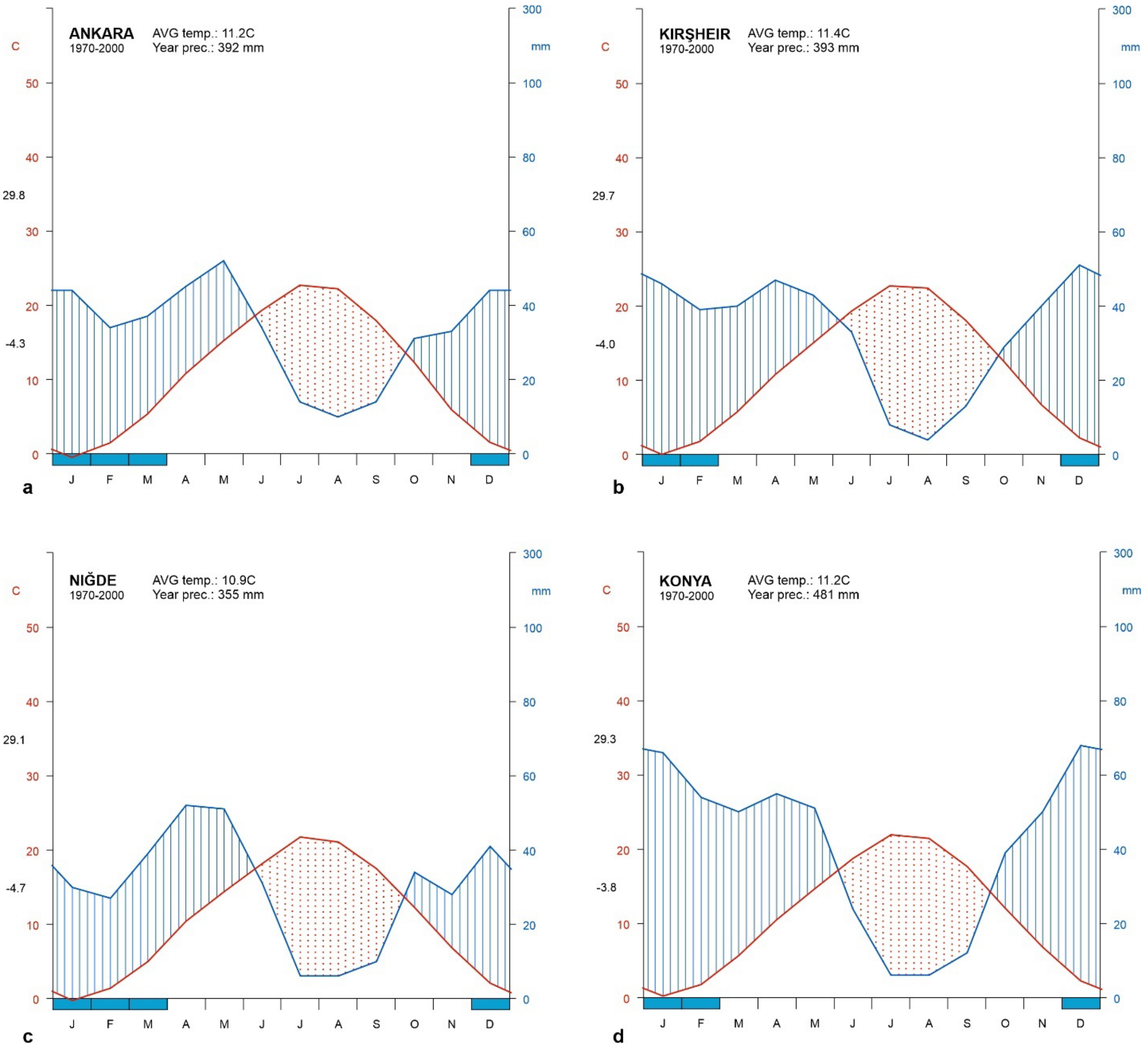


Figure 1.9 – *Ombrothermic diagrams from four localities within the Anatolian Plateau: a, Ankara; b, Kırşehir; c, Nigde; d, Konya. For locations, see Figure 1.8. Climatological data are from WorlClim2 (1970-2000 average), 30-seconds (Fick and Hijmans 2017). The blue line indicates precipitation, the red line temperatures. Average yearly values are reported on top of the panels.*

Central Anatolia is located in the westernmost district of the Irano-Turanian phytogeographical district (Zohary 1973). As first described by Zohary (1973: 179), specific Euxinian (northern Anatolian) arboreal taxa spilled into central Anatolia. These latter taxa contributed to the formation of a xeric steppe-forest, defined by the author as "Xero-Euxinian Steppe-Forest" (Zohary 1973: 179).

As already noted, only a very limited portion of central Anatolia is forested (Figure 1.5 and Figure 1.6). In the current landscape, most of the forested areas are located on the slopes of the mountain ranges surrounding central Anatolia, with wooden cover progressively decreasing towards the core of the region – which is currently treeless (Figure 1.5). The dry forests are dominated by black pine (*Pinus nigra*) and deciduous oak (most commonly *Quercus pubescens*), with junipers (*Juniperus* spp.) increasing in importance in more degraded areas (e.g., Atalay 2018). In addition to the mountains surrounding the central plateau, patchy forested areas are located on the slopes of the reliefs present within central Anatolia, on deep soils and under wetter climatic conditions. In the Cappadocian volcanic complex, for example, the patchy remains of a cold-deciduous forest, dominated by oak (*Quercus* spp.), are present above 1400-1500 m asl, with a lower treeline determined by the altitudinal gradient in precipitations (Section 3.1.4).

The distribution and extension of woodlands in central Anatolia is strongly impacted by a long-term anthropogenic pressure, in form of overgrazing, clearances, and firewood exploitation (Çolak and Rotherham 2006). The patchy forest/scrub belt present on the mountain slopes is commonly interspersed by extensive degraded areas, which are occupied by xeromorphic dwarf-shrublands with thorn-cushions vegetation (e.g., *Astragalus* spp. and *Acantholimon* spp.), likely resulting from overgrazing. On the deforested mountain slopes, stands of isolated rosaceous trees are comparatively common, often present on rocky outcrops (Woldring and Cappers 2001). Zohary (1973: 363) has named these associations as ‘wild orchards’, interpreting them as resulting from selective deforestation of the original deciduous oak forest, which – according to the author – spared these taxa, because of their economic value as wild fruit resources or rootstocks.

The lower elevations of central Anatolia are occupied by steppic vegetation. A plurality of associations are present (Kurt et al. 2006), including xerophytic (dominated by *Artemisa* spp.) and halophitic (commonly dominated by the families of Amaranthaceae and Plumbaginaceae) steppe. In southcentral Anatolia, the latter are commonly occurring on the high saline soils fringing salt-lakes and saltmarshes.

A more detailed discussion of the Cappadocian and Central Taurus vegetation is provided in Section 3.1.4, to which I refer you for additional information.

1.1.2 *An introduction to the main Anatolian ecological regions*

Having provided an overview of the central Anatolian physical geography, in the following paragraphs, I will briefly introduce the other ecological regions defined in the Anatolian Peninsula: Black Sea and Marmara Transitional, Aegean, Mediterranean and Mediterranean Transitional, Southeastern Anatolia, and Eastern Anatolia (Figure 1.7).

- *The Black Sea and the Transitional Marmara regions*

The relief of northern Anatolia is organized within mountain ranges, running parallel to the Black Sea coast, stretching from the Istranca Massif (west) to the Kaçkar Mountains (east), for a total length of ca. 1000 km. This complex orographic system is generally referred to collectively as the Pontus Range. At the base of these mountains, the coastal regions are notably narrow. The main exceptions in these regards are the plains present to the west of the city of Zonguldak and the alluvial deltas of the Kızılırmak and Yeşilırmak rivers, respectively at Bafra and Çarşamba (near Samsun) (Figure 1.1).

The organization of the Pontus relief, forming a long and narrow range, determines a hydrography characterized by short rivers, running from south to north, in the eastern sector of the region often deeply increased in canyons and gorges. Only three rivers originating in either central or eastern Anatolia cut through the Pontus chain, to ultimately drain into the Black Sea: the Kızılırmak (Greek *Halys*); Yeşilırmak (Greek *Iris*); and Sakarya (Greek *Sangarios*).

The climate of northern Anatolia is, in many regards, distinct from the rest of Asia Minor. This region is, in fact, under the influence of humidity tracks from the Black Sea, which underlies an oceanic climate. The northern coast and the sea-facing slopes of the Pontus are wet throughout the entire year, experiencing wet mild-to-cold winters and wet warm summers (Türkeş 2003). Humidity further increases as one moves eastward, reaching up to (1500-2500 mm/year), while in the western areas average yearly values are between 1000 and 1500 mm/year (Figure 1.3).

The humid climate of northern Anatolia supports the presence of a dense forest cover (Figure 1.6), which extends on the northern (more humid) slopes of the Pontus Mountains (Atalay 2018: 15-18). Within these forests, deciduous oaks (*Quercus* spp.), hazelnut (*Corylus avellana*), hornbeam (*Carpinus betulus*), and sweet chestnut (*Castanea sativa*) are the most common wooden taxa found at lower elevations. More upslope, the forest is dominated by Nordmann fir (*Abies nordmanniana*), oriental spruce (*Picia orientalis*), oriental beech (*Fagus orientalis*), and black alder (*Alnus glutinosa*). The understory of the forest is generally occupied by *Rododendron* spp. For a more detailed description of the northern Anatolian vegetation, I recommend consulting Zohary (1973: 570-578).

The region surrounding the Marmara Sea is a transitional zone between the mild-cold-humid climate characteristic of the Black Sea and the Mediterranean climate present along the Aegean coast. This district of Asia Minor could be accordingly considered separately, and it is commonly referred to as the Marmara Transitional (e.g., Atalay 2018). This region is characterized by a comparatively low topography, with extensive lowlands, which supports a rich agricultural landscape. The two main rivers draining the Marmara region are the Meriç/Maritsa, in East Thrace, and the Susurluk, which originates in the relief of northwestern Anatolia. The transitional character of this district is well evidenced in vegetation associations, which include both Euxinian (e.g., *Fagus orientalis*, *Tilia tormentosa*, and *Castanea sativa*) and Mediterranean (e.g., *Pinus brutia* and *Quercus coccifera*) elements.

- *The Aegean region of western Anatolia*

A rugged, very irregular, coastline is characteristic of the Aegean region of the Anatolian Peninsula. The coastal plains fringe an extended inland low massif, which reaches elevations up to 1000 m asl, and gradually merges with the central Anatolian region (Figure 1.1). Western Anatolia is crossed by rivers generally flowing from east to west, from north to south: the Karamenderes (Greek *Scamander*); Gediz (Greek *Hermus*); Büyük Menderes (Greek *Maiandros*); and Küçük Menderes (Greek *Kaistros*). Important protohistoric and historic sites are located in proximity of the mouth of these water courses, which offered wide and fertile valleys and natural communication routes toward the plateau.

Throughout this entire region, both in the coastal and inland areas, the climate is typically Mediterranean: humid and moderately cold winters alternate with comparatively dry and hot summers. Within this general climatic outline, increasingly wetter conditions are registered southwards. To offer an overview, Çanakkale (north) receives an average (1970-2000) of 606 mm/year, Izmir (central) 662 mm/year, and Muğla (south) 1020 mm/year (Figure 1.3).

The vegetation of the Aegean region is, as expected, Mediterranean (Figure 1.6). An eastern Mediterranean maquis and garrigue extend along the coastal belt, which further penetrates inland in correspondence of the river valleys. This maquis is composed by evergreen and fast-growing species, such as olive (*Olea europaea*), carob (*Ceratonia siliqua*), kermes oak (*Quercus coccifera*), pistachio (*Pistacia* spp.), madrones (*Arbutus* spp.), and rockroses (*Cistus* spp.). In the lower belt of the Aegean region, the dominant forest is composed of Turkish pine (*Pinus brutia*), which occurs from the sea level up to 700-800 m asl. Further upslope, the Oro-Mediterranean forest is most commonly composed by black pine (*Pinus nigra*) and deciduous oaks (*Quercus infectoria*, *Q. ithaburensis*, *Q. cerris*, *Q. frainetto*, and *Q. pubescens*) (Atalay 2018).

- *The Mediterranean and Mediterranean Transitional regions*

The Mediterranean region of Anatolia extends along the southern coast of the peninsula. This region is bordered to the north by the Western and Central Taurus mountains, which forms a steep and uninterrupted mountain range, running from west to east for more than 1000 km. The western sector of the Taurus is located on the Take Peninsula, between the cities of Muğla and Antalya. Two main mountain complexes are present in this sector of the Taurus, the Akdağlar and Beydağlari. More to the east, the Central Taurus is divided into the Geyikdağ, Bolkardağ, and Aladağlar ranges (Figure 1.1).

The coastal plains present at the base of the range are generally narrow, with the main exception of the Çukurova (Greek *Pedias Cilicia*) and Antalya (Greek *Pamphyllia*) plains. The rouged coastline present between these two plains is referred as 'Rough Cilicia' (Greek *Tracheia Cilicia*). The two main rivers present in this region are the Seyhan (Greek *Saros*) and the Ceyhan (Greek *Pyramus*). Both rivers reach the sea in proximity of the Iskenderun Gulf (ancient *Issus*), with their alluvium forming the Çukurova Plain. The Nur (Greek *Amanus*) Mountains are located on the opposite side of the Iskenderun Gulf, which diverge from the Taurus with a north to south orientation (Figure 1.2). The southern part of the Amanus range is crossed by the Asi River (Greek *Orontes*), which flows from south (Syria) to north, reaching sea near Hatay (Figure 1.1).

The climate of this region is, not surprisingly, typically Mediterranean. On the coast, an annual average (measured between 1970-2000) of 662 mm/year of precipitation is recorded at Mersin, while 740 mm/year on average occurs in Antalya. A very well-expressed altitudinal precipitation gradient is present, with a sub-humid to humid Mediterranean climate (over than 1000 mm/year) present above 1000-1200 m asl. The complex orography of the Central and Western Taurus underlies the presence of several microclimate.

In comparison to the Aegean region, the more humid sea-facing slopes of the Taurus are characterized by richer forest associations (Figure 1.6). The upper treeline (between 1600–2100 m asl) is composed by a cold-resistant conifer forest, dominated by Cilician fir (*Abies cilicica*) and Lebanese cedar (*Cedrus libani*). Black pine (*Pinus nigra*) woodlands are commonly found at a lower elevations, between ca. 1000 and 1600 m asl. Below the black pine forest, the colline and montane altitudinal belts (between 500 and 1200 m asl) are dominated by the more drought-resistant Turkish pine (*Pinus brutia*). The latter is often found in association to broadleaved trees and shrubs, such as Oaks (*Quercus cerris* and *Q. libani*), hop hornbeam (*Ostrya carpinifolia*), and storax (*Styrax officinalis*). At still lower elevations (<500 m asl), the Mediterranean evergreen shrublands, already described for the Aegean region, become dominant (Kürschner 1984); although, it has been, in large part, cleared as result of agricultural activities.

To the north of Antalya, in the region known in Greek times as *Pisidia*, is located a transitional region between the central Anatolian and Mediterranean ecological domains. This region, which will be referred here as 'Transitional Mediterranean' is characterized by the presence of several lakes (nine large and over twenty small), located within the depressions of the Western Taurus and originating from either tectonic or karstic processes (Kazancı and Roberts 2019). This peculiar aspect has led to the labeling of this region as the 'Lake District'. The smallest of these lakes (e.g., Acıgöl and Burdur Gölü), which formation is due to endorheism, are highly saline. On the other hand, the largest lakes (e.g., Beyşehir Gölü and Eğirdir Gölü) are freshwater.

The climate in the Lake District is influenced by the rain-shadow effect imposed by the Taurus Mountains, which results in an annual average precipitation as low as 400 mm/year. Lebanese cedar (*Cedrus libani*) and black pine (*Pinus nigra*) forests are dominant in the vegetation community, with deciduous oak (*Quercus* spp.) being more prominent in the north (Atalay 2018).

- The highlands of eastern Anatolia

To the east, the Anatolia Peninsula is characterized by a rugged landscape, with high plateaus interspersed by irregular reliefs and deep valleys (Figure 1.1). A large portion of Eastern Anatolia is included in the hydrographic basin of the upper branches of the Euphrates River (Kasusu and Murat). The other hydrographic basins of eastern Anatolia drain into the Caspian Sea (Aras River), the Black Sea (Kızılırmak and Çoruh rivers) and the Mediterranean (Seyhan and Ceyhan rivers) (Figure 1.2). Lake Van, the largest inland water body in Anatolia, is a terminal, soda lake.

The climate in the Eastern Highlands is markedly continental, with very cold winters and mild-warm summers (Figure 1.4). The seasonality in precipitation mirrors the Mediterranean regime, with wet winters and dry summers. The complex orography underlies the presence of marked regional and local variations in rainfall, which can be as low as 300 mm/year in the higher plains. At Erzurum (1800 m asl), the average (measured between 1970-2000) January temperature is -8.5 °C, the July temperature is 18.3 °C, and the average annual precipitation is 496 mm. At Van (1650 m asl), the average January temperature is recorded as -3.7 °C, the average July temperature is 21.9 °C, and a yearly precipitation of 452 mm.

Forests generally extend between 1500 and 2400 m asl. Deciduous oaks (*Quercus infectoria*, *Q. ithaburensis*, *Q. brandii*, *Q. libani*, *Q. robur*, and *Q. Petraea*) are the dominant arboreal component (Atalay 2018: 23). As elsewhere in Anatolia, the extension and distribution of woodlands is strongly impacted by deforestation. The most extensive forests in the region are, at present, located in the Mercan and Bingöl mountains, in the western sector of eastern Anatolia (Figure 1.5 and 1.6).

- *Southeastern Anatolia*

The last region included in this geographic survey is southeastern Anatolia. Located at the base of the southeastern Taurus range, this region is composed of a sequence of rising platforms, from west to east: the Gaziantep, Urfa, and Mardin Plateaus. Elevation rises from west to east, spanning between ca. 400-600 m asl to up to 1000 m asl near Mardin. To the south, the altitude drops in proximity to the Syrian border, merging into the lower northern Mesopotamian plateaus.

The Gaziantep, Urfa, and Mardin Plateaus are crowned to the north by the Southeastern Taurus, while the Amanus Mountains separate southeastern Anatolia from the Mediterranean coast. At the center of southeastern Anatolia, it is located the isolated shield volcano of the Karaca Dağ, which forms an important ecological boundary: to its west extends a uniform plateau, which is included in the Euphrates basin; while to the east the topography is more irregular, with valleys and streams draining into the Tigris River. Both the Euphrates and the Tigris are deeply incised in valleys, 5 to 50 m deep.

The climate of the region mimics the Mediterranean regime, with the main exception of experiencing drier and hotter summers. At Gaziantep, the average (from the years 1970-2000) January temperature is 3.1 °C, the July temperature is 27 °C, and the annual average precipitation is 534 mm. At Mardin for the same period the average January temperature is recorded as 1.6 °C, the July temperature is 29.2 °C, and average yearly precipitation is 733 mm. Precipitation decreases towards the Syrian border, and the average precipitation in some areas is as low as 200-250 mm/year (Figure 1.3).

Woodlands are located on the reliefs fringing the region to the north (Figure 1.6). In the western sector, Turkish pine (*Pinus brutia*) and deciduous oaks (*Quercus* spp.) are dominant, forming both pure and mixed stands (Atalay 2018). To the east of the Karaca Dağ, deciduous oak (*Q. brandii* and *Q. infectoria*) forest are attested. To the south, the lowlands are occupied by open-steppe vegetation (Atalay 2018).

1.2 An outline of central Anatolian history and archaeology: from the Early Bronze Age to the Hellenistic period

After a due introduction to the physical geography of the central Anatolian Plateau (Section 1.1), in this section of Chapter 1, I will briefly outline the regional archaeological and historical trajectory. The geographic and chronological limits of this overview are defined by the main focus of the dissertation project. I will, accordingly, concentrate on central Anatolia, considering the period from the Early Bronze Age (ca. 3000-2000 BCE) to the end of the Hellenistic kingdoms (ca. 1st century CE). In light of the broad time window that I will discuss, this section is to be regarded as purely introductive. A more specific focus on the history and archaeology of southern Cappadocia is provided in Chapter 3, as part of the case study presented in Part II of the dissertation.

1.2.1 The Early Bronze Age (3000-2000 BCE) and the emergence of complex societies in Asia Minor

The Early Bronze Age (EBA) is traditionally divided into three phases: EBA I (ca. 3000-2700/2600 BCE), EBA II (ca. 2700-2600-2300 BCE), and EBA III (ca. 2300-2000 BCE) (Yakar 2011). Several authors have emphasized the somewhat arbitrary nature of this tripartite subdivision of the third millennium, which is mostly grounded on ceramic typology (e.g., Steadman 2011, Düring 2012: 259-260). The single phases of the EBA are further commonly divided into subphases. This latter, finer, periodization of the EBA is, however, to a large extent, bounded to single sites rather than holding a regional value, causing to "*confusing matters rather than providing clarifications*" (Düring 2012: 259).

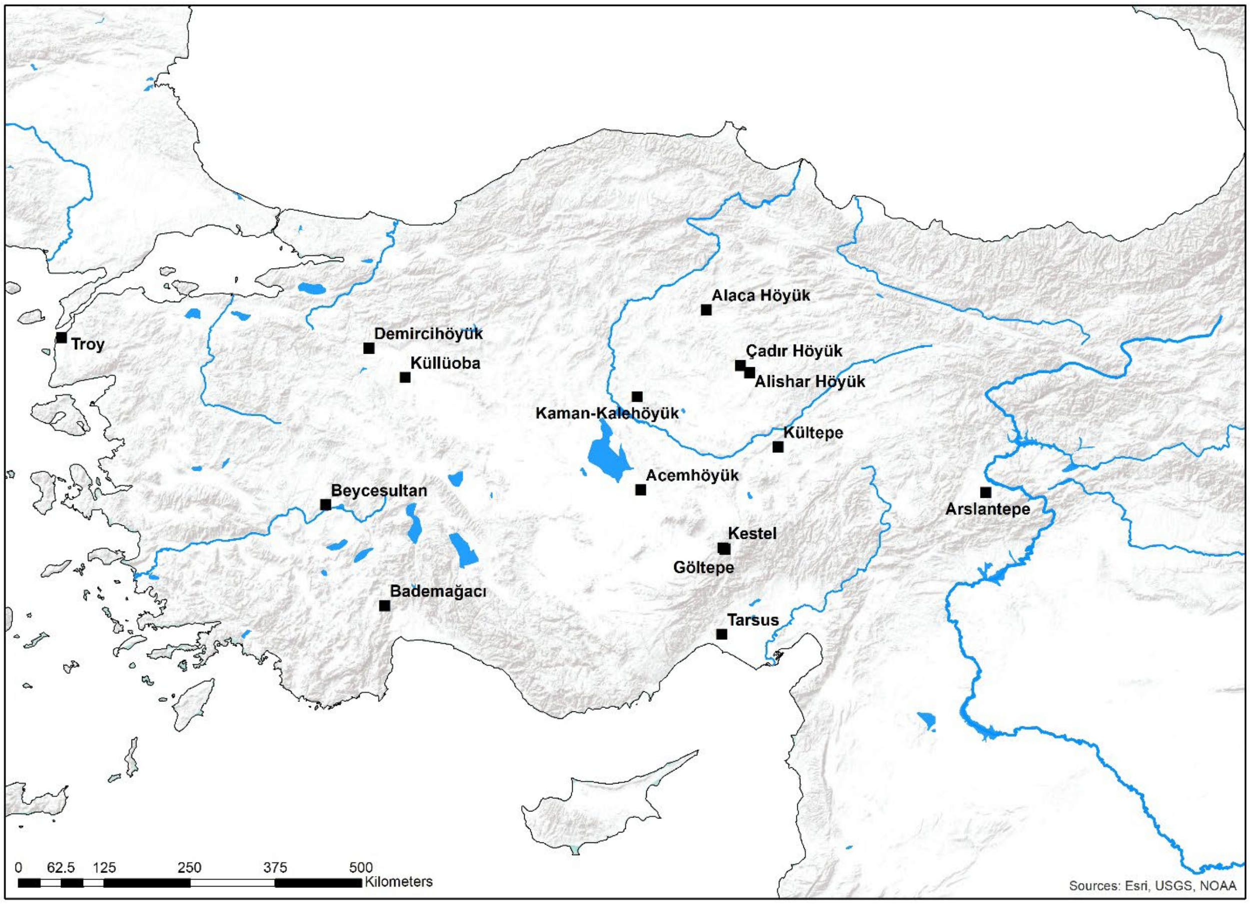

Troy
Demircihöyük
Küllüoba
Alaca Höyük
Çadır Höyük
Alishar Höyük
Kaman-Kalehöyük
Kültepe
Acemhöyük
Beycesultan
Arslantepe
Kestel
Göltepe
Bademağacı
Tarsus
0
62.5
125
250
375
500
Kilometers
Sources: Esri, USGS, NOAA

Figure 1.10 – *Location of the main Early Bronze Age sites discussed in the text*

In central and western Anatolia, the third millennium BCE has traditionally been regarded as defining the onset of social complexity. This later hypothesis is based on the presence of several trends in material culture, which emerged during the EBA II and reached a state of rich full maturation during the EBA III, namely: (*i*) the emergence of urban centers, in the form of fortified citadels; (*ii*) the evidence for the accumulation of wealth, in form of rich burial goods and hoards; (*iii*) the development of metallurgy in association with the establishment of a long-distance trade network; and (*iv*) a specialization in ceramic production with the introduction and increased use of expedient pottery production via the wheel (Bachhuber 2009 and 2014, Düring 2012: 257-299, Efe 2007, Harrison et al. 2021). In comparison with the Upper-Middle Euphrates Valley (e.g., Frangipane 2018) and the

Mesopotamian alluvium (e.g., Stein 2012), the establishment of complex societies in western and central Anatolia appears to have occurred at a significantly later date. The reason for such delay remains debated in the literature (e.g., Algaze 2001, Frangipane 2007).

- *EBA I* (*ca. 3000-2700/2600 BCE*)

The distinction between Late Chalcolithic and EBA I is considered by most authors as rather arbitrary, with evidence of a significant degree of continuity in material culture between the late 4th and early 3rd millennia BCE (Düring 2012: 263). The separation of the two periods is, in large part, grounded on ceramic typology (Steadman 2011, and references therein). The EBA I corresponds to Troy I and Tarsus-Gözlükule Ib, with these two sites representing the reference sequences for, respectively, the Aegean and Mediterranean regions of Anatolia (Steadman 2011).

In the northwestern and western districts of central Anatolia, important EBA I sites are located at Demircihöyük, Beycesultan, and Küllüoba (Steadman 2011, Düring 2012: 263-270). Of note is the site of Demircihöyük, which has a layout for the EBA (Level H) that has been fully reconstructed (Korfmann 1983). This comparatively small village is characterized by a distinctive radial plan, which is composed of megaron-like structures built one adjacent to the other. The buildings opened on a central courtyard, and storage bins were located in the shared open area in front of the megara entrance (Korfmann 1983). The EBA I settlement of Demircihöyük was enclosed by a stone wall, of which interpretation remains debated in the literature: the original hypothesis of this structure being for defensive purposes (Korfmann 1983) has been challenged in later scholarship (Düring 2012: 266-267). A radial settlement layout has been noted also at EBA I levels of Küllüoba (Steadman 2011).

Evidence from northcentral Anatolia dating to the EBA I remains limited (Steadman 2011). The data from the 1920s and 1930s excavations at Alishar Höyük (e.g., von der Osten 1937) are particularly problematic, due to poor stratigraphic and chronological control (Steadman 2011). The main sequence available from EBA I central Anatolia is from the site of Çadır Höyük. Most notably, at the latter site to the EBA I is dated the construction of a fortification wall (Steadman et al 2019: 293). Even more meagre is the evidence from the southern portion of the Anatolian Plateau, a region which remains to date without significant stratified EBA I contexts (Steadman 2011).

- *EBA II* (*ca. 2700/2600-2300 BCE*)

In the regional chronology, the EBA II corresponds to Troy II and Tarsus-Gözlükule II (Steadman 2011). At the site of Troy, this period is most notably associated with at least 20 'hoards', including the famous "treasure of Priam" (Treasure A) from Schliemann's excavations. The hoards from Troy are no longer considered to be a unicum in the Anatolian context, but rather to reflect a form of wealth accumulation, which took place in close association to the regional development of metallurgy. In central Anatolia, of particular importance is the coeval and, in many regards, similar hoard from Eskiyapar (Bachhuber 2009).

Beycesultan (Levels XVI-XIII) and Küllüoba are the two main excavated EBA II sites in western central Anatolia (Steadman 2011). The site of Küllüoba is organized in a radial plan, which included an upper settlement encircled by a wall. According to Efe (2007) in this latter portion of the site were included buildings having non-domestic, but rather administrative functions. Outside western central Anatolia, very little evidence is to date available for the EBA II, which includes residual materials from

Çadır Höyük and the stratigraphically problematic sequence from Alishar Höyük (Steadman 2011). In the Lake District of southwestern Anatolia, north of Antalya, an EBA II occupation is documented at Bademağacı: the settlement is characterized by a radial layout, with megaron-like structures, recalling similar layout from northwestern Anatolia. It is worth noting the presence at Bademağacı of stamp seals, which hint to the existence of an administrative system (Steadman 2011). Further to the south, in Lycia, it is located the site of Karataş: a flat, non-enclosed, settlement occupied throughout the first half of the 3rd millennium BCE (Bachhuber 2014: 70-80, and therein references).

- *EBA III* (*ca. 2300-2000 BCE*)

The EBA III corresponds to Troy III and Tarsus-Gözlükule III (Steadman 2011). This period is less well-represented in western central Anatolian. At Beycesultan (Level XII-VIII) megara structures are attested, which suggest a continuity of this building tradition into the end of the millennium (Steadman 2011). In northcentral Anatolia, EBA III levels are known from Çadır Höyük (Phase IIa) and Alishar Höyük (Levels 6-5M on the mound and 13 T on the terrace). The latter site appears to have represented, during the EBA III, a substantial settlement, with two circles of walls which enclosed respectively the terrace (Level 13T walls) and the citadel (Level 6M walls) (Steadman 2011, and references therein). Alaca Höyük is another important EBA III site in northcentral Anatolia, which includes 14 rich burials commonly referred in the literature as "royal tombs". The extraordinary funerary accoutrement in these latter burials include a rich assemblage of elaborated metal standards and weapons. Similar funerary contexts have been discovered elsewhere in central Anatolia – e.g., Horoztepe, Kalinkaya, and Mahmatlar (Düring 2012: 290, and references therein).

In southcentral Anatolia, excavations have reached EBA III stratified layers at Kültepe, Acemhöyük, and Kaman-Kalehöyük, all important sites for the 2nd millennium BCE (Düring 2012: 295). Of particular interest is the evidence from the EBA III levels of the mound of Kültepe, which includes a building of monumental sizes (Ezer 2014, Kulakoğlu 2017). Kültepe is accordingly interpreted as a site of regional importance in the centuries preceding its flourishing and the establishment of the Middle Bronze Age Assyrian trade colony (Section 1.2.2).

As a final note, Early Bronze Age mining sites have been located on the Bolkar Mountains, in the Central Taurus (Yener 2000). In this region, which is particularly rich in polymetallic ore deposits, two sites are radiocarbon dated to the EBA II/III: Kestel mine and Göltepe. The evidence accumulated by Yener (2000) supports the presence of tin mining activities, with the metallic ore extracted at Kestel and processed at the nearby site of Göltepe. This hypothesis prompted an animated debate in the literature, considering the dominant paradigm of an extra-Anatolian origin of the tin used in central Anatolia (Düring 2012: 276, and references therein).

1.2.2 The Middle Bronze Age (2000-1600 BCE) and the Assyrian trading colonies

The Middle Bronze Age (MBA) is conventionally dated from 2000 BCE to 1700/1600 BCE (e.g., Yakar 2011). This period corresponds to the establishment of the Old Assyrian trading centers in central Anatolia, which flourished within a fluid regional political landscape defined by a constellation of principalities. It is from this fragmented context, that the Hittite Old Kingdom emerged in the 17th century BCE. The Assyrian presence in central Anatolia corresponds to the first written documentation available from the region (Michel 2011).

The two poles in the Anatolian MBA long-distance trade network were (*i*) the city of *Aššur*, in the Middle Tigris Valley, and (*ii*) the Assyrian trade centers located in the lower towns of several Anatolian urban centers (e.g., Barjamovic 2008, Michel 2011, Barjamovic et al. 2012, Dercksen 2014, Larsen 2015, Pamisano 2018). The bulk of this trade was based on tin (originating from central Asia) and textile (from southern Babylonia and *Aššur* itself), which were exchanged by Assyrians for Anatolian silver. This trade network appears to have been structured and regulated by agreements between Anatolian ruler elites and Assyrian institutions, which included treaties established between the two parts. In these later documents, trading privileges were given to the local rulers, in exchange of a juridical protection and trade monopoly. For a discussion of the Old Assyrian trade network, I refer to Larsen 2015 and therein bibliography.

Assyrian traders in central Anatolia were settled in *kārum* and *wabartum*. The former term refers to Assyrian merchant districts located in the lower town of an Anatolia settlement. *Wabartum*, on the other end, indicates smaller trading posts. The *kārum* housed at Kültepe-*Kaneš*, a site located at a short distance from today's city of Kayseri, appears to have been at the center of this network of Assyrian trading centers (Michel 2011, Larsen 2015). As with most Bronze Age mounded sites, Kültepe is divided into a lower town and a citadel. The Middle Bronze Age is represented by Levels 10-6 of the citadel and Levels IV-I in the lower town. The citadel would have been the seat of the local ruler, while the lower town during Level II and Ia housed the largest Assyrian *kārum* currently known to have existed in Anatolia. The most active period of this latter Assyrian colony appears to have been during Level II, which is dated from the mid-20th to the second half of the 19th centuries BCE. After a gap in occupation (Level Ic), the *kārum* was settled again by Assyrian merchants during the period of occupation represented by Level Ib, which dates to the 18th century BCE. Assyrian presence at the site is not documented during period Ia, dated to the beginning of the 17th century BCE (Michel 2011, and references therein).

The majority of the Old Assyrian cuneiform tablets (more than 22,000) discovered at Kültepe-*Kaneš* dates to the *kārum* Level II period. In a 2011 publication, a total of 420 tablets were attributed to *kārum* Level Ib (Michel 2011). Furthermore, Michel (2011) reports 40 tablets brought to light during excavations on the citadel. The tablets from the *kārum* of Kültepe-*Kaneš* are overwhelmingly associated to the private archives of Assyrian merchants, with only a small fraction belonging to Anatolian traders. The bulk of these documents are composed of private letters, legal documents, various lists, notices, and memoranda (Larsen 2015, and references therein). In addition to providing a unique view on ancient trade and economic history, the Old Assyrian archives from Kültepe-*Kaneš* could tangentially inform on the Middle Bronze Age political organization of central Anatolia. The local political landscape appears to have been characterized by a constellation of principalities, governed by local rulers, referred to in the Assyrian sources as *rubā'um* (prince) and *rubātum* ("princess"). Both in an urbanistic and institutional sense, at the center of these principalities is located the palace: large buildings dominating the citadels, representing the focal point of a complex administrative system.

The power balance between these different 'city-states' appears to have been rather unstable, with an endemic competitiveness, which appears to have often escalated into open hostilities and wars. These latter events are mentioned by the Assyrian merchants as disrupting regular trading activities (Michel 2011). In documents from Level II, 20 other Anatolian settlements are listed as seat of a *kārum* and 15 of a *wabartum*. (Michel 2011). *Kaneš* was, thus, part of a broader trading network. The frequent occurrence of toponyms in the documents from *Kaneš* have promoted the establishment of a productive scholarship on the historical geography of Middle Bronze Age Anatolia (Barjamovic 2011).

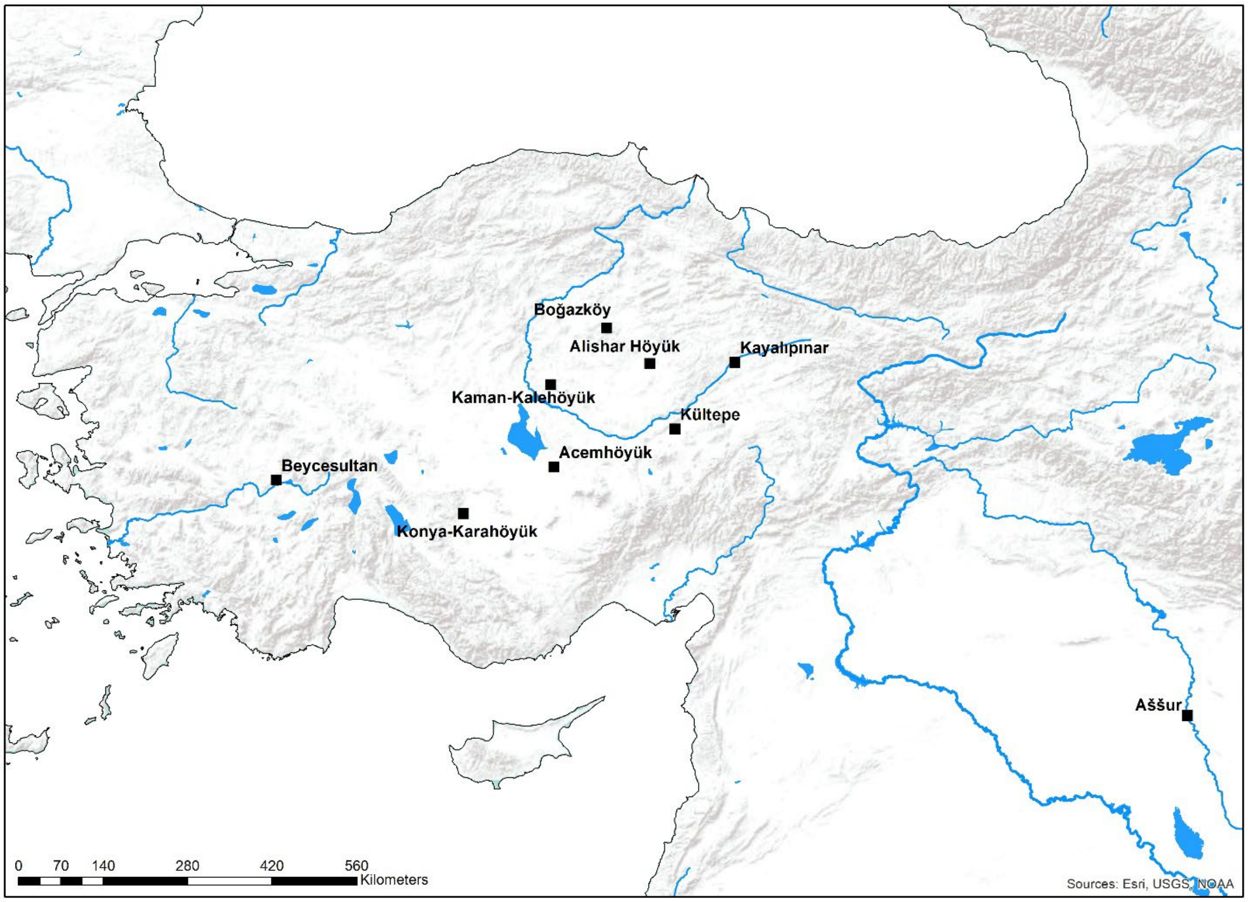

Boğazköy
Alishar Höyük
Kayalıpınar
Kaman-Kalehöyük
Kültepe
Acemhöyük
Beycesultan
Konya-Karahöyük
Aššur
0 70 140 280 420 560
Kilometers
Sources: Esri, USGS, NOAA

Figure 1.11 – *Location of the main Middle Bronze Age sites discussed in the text*

In addition to the finds from Kültepe-*Kaneš*, coeval Old Assyrian written tables are known from Boğazköy (72 tablets), Alishar Höyük (63 tablets), Kaman-Kalehöyük (1 tablet), Kayalıpınar (1 tablet) (Barjamovic 2011: 56, with references), and Acemhöyük (Kuzuoğlu 2016) (Figure 1.11). Among these sites, Alishar Höyük and Boğazköy are identified respectively by the Old Assyrian toponyms of *Amkuwa* (Barjamovic 2011: 312-316) and *Ḫattuš* (Barjamovic 2011: 292-296). Of further importance among MBA Anatolian sites, is Acemhöyük, a large settlement (ca. 56 ha) located roughly 20 km to the northwest of

Aksaray (Özgüç 1966). Although a *kārum* has not been located, the involvement of Acemhöyük in the long-distance trade network appears corroborated by the discovery of bullae holding short cuneiform inscriptions, seal impressions of Šamši-Adad I and his servants, a collection of seals, and fragmentary Old Assyrian tablets (Kuzuoğlu 2016). Similar considerations have been moved for Karahöyük-Konya – a large MBA site (50 ha) from which originates a large collection of seal impressions (Alp 1968). Further to the west, MBA strata have been extensively exposed at Beycesultan (Levels V and IV) (Llyod 1965: 3-34). Evidence of an involvement of this latter site in the Assyrian trade network is, however, at present missing (Michel 2011).

1.2.3 The Late Bronze Age (1600-1180 BCE) and the Hittite Kingdom

In the Old Assyrian textual record from *Kaneš*, the Anatolian political landscape appears characterized by fragmentation and conflict, with different principalities struggling for obtaining a hegemonic position on the Anatolian Plateau, or part of it. Within this context, a later Old Hittite text, the so-called Proclamation of Anitta (CHT 1), narrates the military campaigns of Anitta, king of *Kuššar* (e.g., Carruba 2003, Beckman 2006). According to his deeds, Annita destroyed and cursed the city of *Ḫattuš* – sowing weeds on the city ground, symbolizing that the site should never be resettled again. It is another "man of *Kuššar*" who will revert this curse, by making *Ḫattuš* his capital and by changing his throne name after it: Ḫattušili (e.g., Klengel et al. 1999, Bryce 2005, Beal 2011).

The military deeds of Ḫattušili are described in his annals (CHT 4), in the so-called testament (CHT 6), and in the historical preamble contained in the Proclamation of Telipinu (CHT 19). On the basis of these sources, Ḫattušili conducted extensive military campaigns in the Pontus (*Zalpa*) and in western Anatolia (*Arzawa*), which ultimately assured the control of *Ḫattuš* over the entire central Anatolia. Furthermore, Ḫattušili conducted military campaigns in northern Syria, which are regarded as successful; although, they do not appear to have led to any territorial expansion (Bryce 2005: 61-95)

Following the reign of Ḫattušili, in the roughly four–centuries-long history of the Hittite polity, the "Land of *Ḫatti*" will remain the political and territorial core of the kingdom: located within the bend of the Kızılırmak River (the Hittite *Marassantiya*), and centered on the capital city of *Ḫattuša*, modern Boğazköy (e.g., Klengel et al. 1999, Bryce 2005) (Figure 1.12). With the sole exception of a brief period during the reign of Muwatalli (early 13th century BCE), in which the political center was moved to *Tarḫuntašša*, the city of *Ḫattuša* remained the capital of the Hittite Kingdom, until its abandonment and destruction in the early 12th century BCE.

Throughout the Late Bronze Age, northcentral Anatolia (the Land of *Ḫatti*) remained under comparatively solid Hittite control. Single exceptions are mostly associated with either phases of internal political turmoil or raids conducted by the nearby population of the *Kaška* (Singer 2007). The hostile activities of the *Kaška* allegedly culminated in the plundering of *Ḫattuša* itself, during the reign of Tudḫaliya II/III.

Outside the Land of *Ḫatti*, the Hittite political and military control appears to have been less stable, with frequent challenges originating from both internal revolts and the interference of other political powers. At its zenith, during the reign of Šuppiluliuma I, the Hittite Empire controlled northern Syria and the northern Levantine coast, including the powerful cities of Ugarit, Aleppo, and Karkemish – the latter two centers ruled by Hittite viceroys (Figure 1.12). The Hittite Empire, thus, emerged as a main supraregional power, which eventually took active part in the international diplomatic exchange network defining this period. In this context, the Hittite great king had a rank of equal to the other Near Eastern main political players: the Egyptian pharaoh, and the kings of Assyria, Babylonia, and Mitanni (e.g., Liverani 2011).

After a phase of internal turmoil, resulting from disputes of succession and military instability (e.g., Singer 2000, 2009), at the onset of the 12th century BCE, during the reign of Šuppiluliuma II, the Hittite Empire collapsed. The fall of *Ḫatti* is part of a broader reconfiguration of the western Asian political landscape – a topic on which much has been written (e.g., Ward and Joukowsky 1992, Sherratt 1998, Borgna and Cassola Guida 2009, Liverani 2014: 381–400, Cline 2014). I will return on the collapse of *Ḫatti* in Section 1.2.4.

The historical chronology of the Hittite Empire has been discussed by, among others, Dinçol (2006) and Beckman (2000). The Hittite documents allow for a reconstruction of the relative sequence of rulers, with single uncertainties mostly connected to instances of homonymy in throne names (Beckman 2000). On the other hand, the absolute chronology of the dynastic history of the Hittite Kingdom relies fully on synchronism with external calendar systems: the Babylonian, Middle Assyrian, and Egyptian chronologies (Dinçol 2006, Beckman 2000). The long-standing issues in Near Eastern chronology are consequently directly transposed into the absolute dating of the Hittite rulers, based on whether the high, middle, low, or ultra-low Babylonian chronology is followed (Dinçol 2006, and references therein).

OLD PERIOD	**OLD KINGDOM**	*0*	**Ḫuzziya**		
		1	**Labarna** (son of 0)		
		2	**Ḫattušili I** (nephew of 1)		
		3	**Muršili I** (grandson of 2)	Sack of Babylon	1651/1595/1531 BCE
		4	**Ḫantili I** (brother-in-love of 3)		
		5	**Zidanta I** (son-in-law 4?)		
		6	**Ammuna** (son of 5)		
		7	**Ḫuzziya I** (son of 6?)		
		8	**Telipinu** (brother-in-low of 7)		
		9	**Taḫurwaili**		
MIDDLE PERIOD		*10*	**Alluwamna** (son-in-low 8)		
		11	**Ḫantili II** (son of 10)		
		12	**Zidanta II**		
		13	**Ḫuzziya II** (son of 12?)		
		14	**Muwatalli I**		
	NEW KINGDOM	*15*	**Tutḫaliya I** (son of 13)		
		16	**Arnuwanda I** (son-in-law of 15)		
		17	**Tutḫaliya II** (son of 16)		
		18	**Tutḫaliya III** (son of 17)		
GREAT EMPIRE		*19*	**Šuppiluliuma I** (son of 17)	Dispatch to the Pharaoh Ḫuriya (Smenkhkare?) *daḫamunzu* episode	1338 1323
		20	**Arnuwanda II** (son of 19)		
		21	**Muršili II** (son of 19)	Eclipse? On a campaign against Azzi	1322
		22	**Muwatalli II** (son of 21)	Battle of *Qadeš*	1275
		23	**Muršili III** (Urḫi-Teššub) (son of 22)		
		24	**Ḫattušili III** (son of 21)	Peace treaty with Egypt *Marriage between Ramses II and* Ḫattušili's daughter	1258 1245
		25	**Tutḫaliya IV** (son of 24)	Battle of *Niḫriya* against Tukulti-Ninurta I of Assyria	1239
		26	**Karunta** (Ulmi-Teššub) (son of 22)		
		27	**Arnuwanda III** (son of 25)		
		28	**Šuppiluliuma II** (son of 25)		

Table 1.1 – *Overview of Hittite dynastic chronology. Redrawn from Genz and Mielke 2011. For the tripartite subdivision of the Hittite period see Klengel 1999; a bipartite subdivision follows Bryce 2005.*

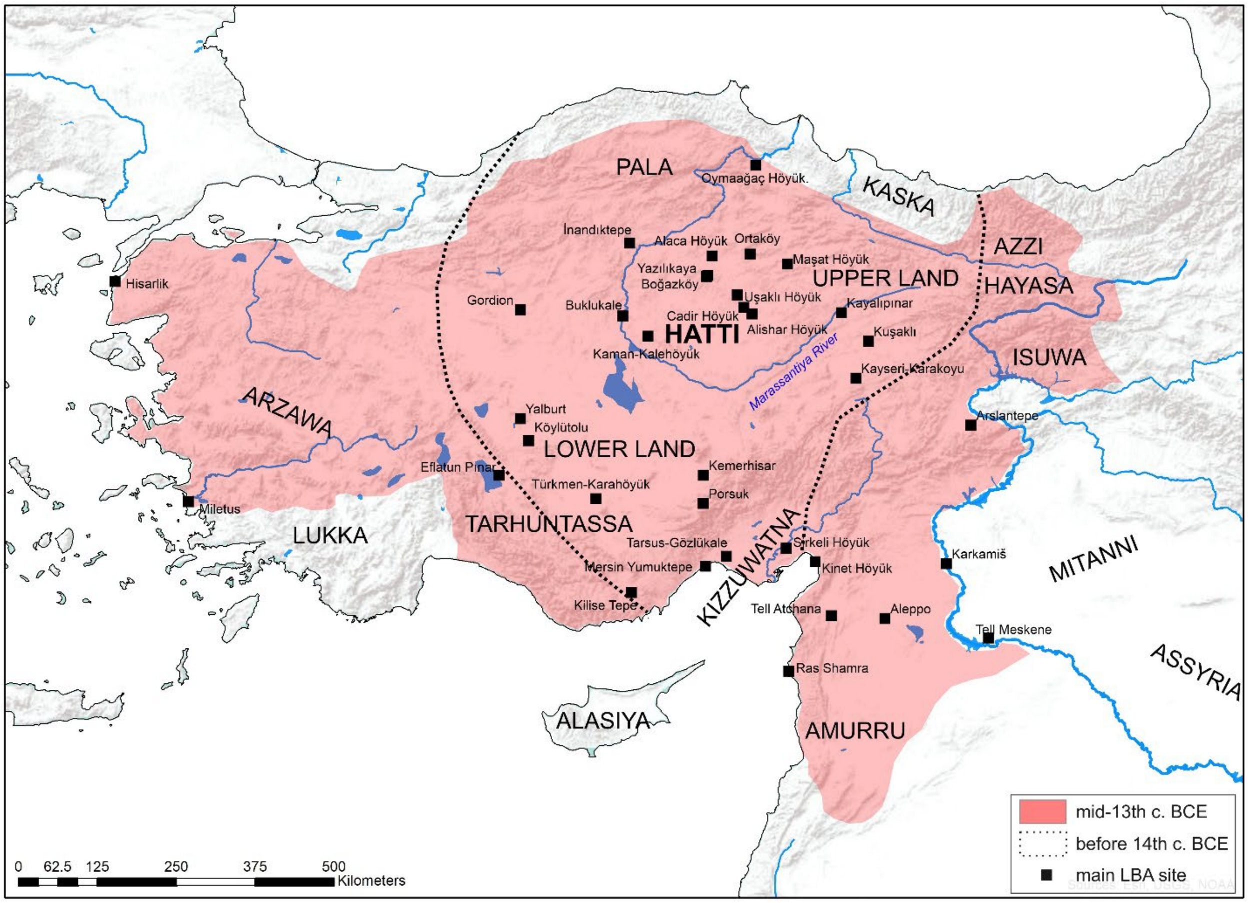

PALA
KASKA
AZZI
HAYASA
ISUWA
UPPER LAND
HATTI
LOWER LAND
ARZAWA
LUKKA
TARHUNTASSA
KIZZUWATNA
MITANNI
ASSYRIA
ALASIYA
AMURRU
Marassantiya River
Oymaağaç Höyük
İnandıktepe
Alaca Höyük
Ortaköy
Maşat Höyük
Yazılıkaya
Boğazköy
Uşaklı Höyük
Cadir Höyük
Alishar Höyük
Kayalıpınar
Kuşaklı
Kayseri-Karakoyu
Gordion
Buklukale
Kaman-Kalehöyük
Hisarlik
Yalburt
Köylütolu
Eflatun Pinar
Türkmen-Karahöyük
Kemerhisar
Porsuk
Miletus
Tarsus-Gözlükale
Mersin Yumuktepe
Kilise Tepe
Sirkeli Höyük
Kinet Höyük
Arslantepe
Karkamiš
Tell Atchana
Aleppo
Tell Meskene
Ras Shamra
0
62.5
125
250
375
500
Kilometers
🟥 mid-13th c. BCE
⬚ before 14th c. BCE
■ main LBA site

Figure 1.12 – *Location of the main Late Bronze Age sites discussed in the text. In the map it is indicated approximative extension of the Hittite domain around the mid-13th c. BCE (reign of Šuppiluliuma I) and before the 14th century BCE. The main regional toponyms are reported.*

The Middle chronology has been traditionally used as conventional scale to date events in ancient western Asia. In more recent years, however, it is registered a tendency to favor the low chronology (Yakar 2011, and references therein). The difference between middle and low chronology is of about 64 years: the sack of Babylon by the Hittite Great King Muršili I would accordingly date to either 1594 BCE (middle chronology) or 1531 BCE (low chronology) (Dinçol 2006). Radiocarbon and dendrochronology, on the other hand, have recently favored the hypothesis of a 'Low-Middle Chronology', which deviates of ca. 8 years from the standard Middle Chronology (Manning et al. 2016).

Better defined is the absolute chronology of the last century of the Hittite Empire, which could rely on direct synchronisms with Egypt (Dinçol 2006).

- *Hittite textual sources*

Two writing systems are attested in Late Bronze Age, Hittite, Anatolia: a local hieroglyphic script and cuneiform Hittite. The establishment and development of the latter is in rupture with the Middle Bronze Age (Old Assyrian) cuneiform tradition (Section 1.2.2). There is general consensus, in fact, in tracing the origin of Hittite cuneiform from northern Syrian, rather than from the Old Assyrian MBA trading centers. The cuneiform writing system was likely first adopted by the Hittite court after the Syrian campaigns of Ḫattušili I. The volume of writing at Ḫattuša appears to have progressively increased during the Old Kingdom, at first using exclusively the Akkadian, and starting from the early 15th century BCE also by adapting this syllabic script to the Hittite language. This process appears to reach a conclusion by the end of the 15th century BCE, with the bulk of the internal documents being written in Hittite (e.g., van den Hout 2020, and references therein).

A total of ca. 30,000 Hittite tablets and tablet fragments have been so far published (van den Hout 2020). This rich corpus of texts is classified using the *Catalogue des Textes Hittites* (CTH), a system introduced by Emanuel Laroche (1971) and currently maintained and updated by Wurzburg University. The overwhelming majority of the Hittite texts have been discovered at the capital city of Boğazköy-*Ḫattuša*. The largest collection of texts outside *Ḫattuša* was located at the royal residence of Ortaköy-*Šapinuwa*, and they represent a rich corpus still awaiting publication. In addition to *Ḫattuša* and *Šapinuwa*, an additional archive has been discovered at the Hittite provincial palace of Maşat Höyük-

Tapikka. Small collections of texts are known from other central Anatolian sites, including Kuşaklı-*Šareššа*, Kayalıpınar-*Šamuḫa*(?), Oymaağaç Höyük-*Nerik*, Alaca Höyük, Uşaklı Höyük, and Büklükale (Figure 1.12). Outside central Anatolia, Hittite texts have been discovered at Tarsus in Cilicia and at the Syrian sites of Tell Atchana-*Alalaḫ*, Dur Kurigalzu, Meskene-*Emar*, and Ras Shamra-*Ugarit*. Finally, two Hittite letters are included in the Tel-el-Amarna archive, in Egypt (van den Hout 2020, and references therein).

- *The main Late Bronze Age site in central Anatolia*

The Hittite capital, *Ḫattuša*, is located near the village of Boğazköy, in the Turkish province of Çorum (Figure 1.12). The site of *Ḫattuša* stretches over an impressive area of more than 180 ha, enclosed by a monumental fortification system, and encompassing a complex topography composed of ridges, valleys, and plateaus (e.g., Schachner 2011). The first excavations at Boğazköy were conducted in 1893-1894 by Ernst Chantre. It was, however, only in the early 20th century that Hugo Winckler and Theodor Makridi Bey identified the site as the (until then forgotten) capital of the Hittite Empire. *Ḫattuša* has been excavated by the German Archaeological Institute, under the direction of Kurt Bittel (1931-1977), Peter Neve (1978-1993), Jürgen Seeher (1994–2005), and Andreas Schachner (since 2006) (Schachner 2011, Mielke 2011).

In addition to *Ḫattuša*, several other Late Bronze Age sites have been excavated within the bend of the Kızılırmak River, 'the Land of *Ḫatti*' (Figure 1.12). At about 25 km to the north of *Ḫattuša* the site of Alaca Höyük is located, which holds monumental Hittite remains, such as the so-called 'Sphinx Gate' and the 'Temple-Palace' (Çınaroğlu and Çelik 2010). A second important Hittite site located in proximity to the capital (ca. 60 km to the northeast) is Ortaköy, which is identified with the royal residence of *Šapinuwa* (Süel 2015). Further to the northeast, Özgüç (1978, 1982) excavated the mound of Maşat Höyük, which corresponds to the Hittite border town of *Tapikka*. A cluster of Late Bronze Age sites is located in the Province of Yozgat, to the southeast of *Ḫattuša*: Alishar Höyük (von der Osten 1937), Çadir Höyük (Ross et al. 2019), and Uşaklı Höyük (d'Agostino et al. 2021). The former site has been identified with the Hittite toponym of *Ankuwa*, while the other two centers are considered possible candidates for the sacred city of *Zippalanda* (e.g., Gorny 1997). More to the south, near Kirşehir, a Late Bronze Age occupation is known from Kaman-Kalehöyük (Omura 2011). To the north of the proper Land of *Ḫatti*, in the Pontus, a recent excavation project led by Rainer Maria Czichon led to the very likely identification at Oymaağaç Höyük of the sacred city of *Nerik* (Czichon and Mielke 2020) (Figure 1.12).

In the region to the east of the *Marassantiya* River (Figure 1.12), an excavation project conducted from 1992 to 2004, under the direction of Andreas Müller-Karpe, extensively exposed the Late Bronze Age site of Kuşaklı, identified with the Hittite toponym of *Šarešša* (e.g., Arnhold 2009). At a short distance from Kuşaklı, a second Late Bronze Age site is known at Kayalıpınar, possibly to be identified with ancient *Šamuḫa* (Müller-Karpe 2006). Further to the east, in the periphery of the Hittite domain, Late Bronze Age sites have been excavated in the Upper-Middle Euphrates Valley, at Arslantepe (Manuelli 2013), Korucutepe (van Loon 1980), Imikuşaği (Konyar 2006), and Norşuntepe (Korbel 1985) (Figure 1.12).

Other regions in the Anatolian Plateau remain poorly studied for the Late Bronze Age period.

To the west of the *Marassantiya*, to be mentioned are the sites of İnandıktepe (Özgüç 1988) and Gordion (Kealhofer et al. 2019). In southcentral Anatolia, Late Bronze Age evidence is limited to the French excavation project at Poruk (e.g., Kuniholm et al. 1992), tentatively identified with ancient *Ulukišla*. More recently, LBA strata have been intercepted in a deep trench from Niğde-Kınık Höyük (Chapter 3). This meagre picture is likely to drastically improve with the (hoped for) beginning of excavations at the large site of Türkmen-Karahöyük – which, on the basis of surface materials, appears to represent a major site throughout the 2nd and 1st millennia BCE, tentatively regarded as a good candidate for the 'lost' city of *Tarḫuntašša* (Osborne et al. 2020).

In addition to the aforementioned sites, which are all connected to urban centers (Mielke 2011a, 2011b), a brief mention needs to be made also of other Hittite extra-urban sites – most notably in the case of water reservoirs and pools, which have been excavated and surveyed at Eflatunpınar (Mellaart 1962), Yalburt Yailasi (Harmanşah et al. 2017: 315-319), Köylütolu Yayla (Harmanşah et al. 2017: 310-315), and Karakuyu-Kayseri (Emre 1993).

1.2.4 The Iron Age in Central Anatolia

At the onset of the 12th century BCE, the Hittite Empire collapsed. The capital, *Ḫattuša*, was likely abandoned by the royal court and destroyed by a sequence of fires (Seeher 2001). The end of the Hittite polity corresponded to what appears to have been a complete disappearance of cuneiform literacy from central Anatolia (van den Hout 2020). Furthermore, the mass-produced Hittite 'Drab-Ware' (Schoop 2011) is not attested in layers postdating this period, and new ceramic traditions spread in central Anatolia (Genz 2004). The processes and factors underlying the collapse of the Hittite polity, and more generally of the Late Bronze Age Palatial societies, remain at the center of a century-long scholarly debate (e.g., Ward and Joukowsky 1992, Sherratt 1998, Borgna and Cassola Guida 2009, Liverani 2014: 381–400, Cline 2014).

In addition to archaeological evidence, our knowledge of Iron Age central Anatolia relies on textual records, including sources from both within and outside the region. While cuneiform writing appears to have disappeared from this region, but the Anatolian Hieroglyphic writing system was transmitted. It is, in fact, in the first centuries of the 1st millennium BCE that the use of this script appears to have reached a momentum, becoming in southcentral Anatolia and in northern Syria the medium through which local elites and rulers promoted a self-celebratory discourse, by means of inscribed landscape monuments, orthostats, and stelae (Hawkins 2000, Payne 2012). In addition to the indigenous epigraphic corpus, which includes also alphabetic inscriptions (e.g., in Phrygian, Lydian, Aramaic), central Anatolian matters are comparatively often mentioned in coeval Neo-Assyrian sources (e.g., Bryce 2012, and references therein), as well as in the later Graeco-Roman tradition (e.g., Sams 2011, and references therein).

Over the past two decades, archaeological research on Iron Age central Anatolia has significantly expanded. In recent scholarship, a particular attention has been given to the development of more precise chronological frameworks, both concerning site-specific periodization and regional synchronization (e.g., Kealhofer and Grave 2011). The onset of this phase of research might be traced to the establishment of the 'New Chronology' at Gordion, which on the basis of radiocarbon evidence dated the destruction level (YHSS 6A) of the Phrygian capital one century earlier (ca. 800 BCE) than what was previously considered (Rose and Darbyshire 2011). The new dating of the Early Phrygian destruction level from Gordion triggered a general revision of the Early and Middle Iron Age chronology across the plateau, a process which is to a large extent still ongoing. The far-reaching repercussions of this revision in the regional chronology are not yet fully processed, in both archaeological and historical scholarship (e.g., d'Alfonso 2019).

Despite the progresses in Anatolian Iron Age chronology, several important issues are still awaiting to be resolved. To start with, a regional periodization for the Iron Age remains a *desideratum*, in Geoffrey Summer's words "*Any attempt to creating an overall scheme, ..., which is acceptable to everyone working in the field is doomed to failure*" (Summer 2008: 213). Keeping in mind these underlying issues, throughout this dissertation, I will follow a tripartite subdivision of the Iron Age, which consists of: (*i*) Early Iron Age (EIA), 12th- 9th century BCE; (*ii*) Middle Iron Age (MIA), 9th to mid-7th century BCE; and (*iii*) Late Iron Age (LIA), mid-7th century to mid-6th century BCE (Summers 2008: 210). This periodization can be associated to some main historic trends, as I will briefly discuss below.

- *The aftermath of the Hittite Empire collapse*

The formerly dominant narrative of a 'Dark Age' following the collapse of the Hittite Empire has been fully overthrown by more recent scholarship (e.g., Hawkins 1988, 2000: 73-79, Sams 2011: 605-607, Mora and d'Alfonso 2012a, Frangipane and Liverani 2013, Castellano 2018, d'Alfonso 2020). Monolithic reconstructions have been disregarded, in favor of the recognition of different regional socio-cultural and political trajectories occurring in the aftermath of the fall of *Ḫattuša.*

An important degree of discontinuity is observed in the former core region of the Empire, within the bend of the Kızılırmak River (Figure 1.12). At the center of this region, the former capital of *Ḫattuša* remained occupied throughout the Early Iron Age (Schoop and Seeher 2006: 70). However, the monumental city, home during the Late Bronze Age to 'the thousand gods of *Ḫatti*', turned into what was likely to be a small rural settlement, located on the outcrop of Büyükkaya and with a handmade ceramic production in discontinuity with the Late Bronze Age ceramic tradition (Genz 2004: 24). The pottery wheel technology appears to have been abandoned also at Gordion (YHSS 7B), in western central Anatolia. At this latter site, the introduction of a new ceramic assemblage is further attested, which is considered by the excavators of Balkan derivation (Voigt and Henrickson 2000: 42-46). The Early Iron Age evidence from Gordion has been, accordingly, regarded as indicative of the arrival in central Anatolia of an allochthonous population (e.g., Sams 2011). Other authors, such as Genz (2005), have interpreted the widespread changes throughout Anatolia in ceramic technology and typology as connected to local traditions, which resurface in the archaeological record after the fall of the empire.

In contrast to north and western regions of central Anatolia, both epigraphic and archaeological evidence support the argument that there was a partial survival of aspects of the Late Bronze Age, Hittite, tradition in the former eastern and southern peripheries of the empire (e.g., Mora and d'Alfonso 2012a). In addition to ceramic typologies (e.g., Manuelli 2012: 367-369) and settlement pattern (e.g., Mora and d'Alfonso 2012a), this continuity is most notably documented in the use of the Anatolian Hieroglyphic script (Figure 1.13), most commonly using Luwian as main language (Hawkins 2000, Payne 2012). A political and dynastic continuity between Late Bronze and Iron Age is to date documented in the Middle and Upper-Middle Euphrates region (Hawkins 1988). Other models of transmission of the Hittite heritage into the 1st Millennium BCE have been proposed for southcentral Anatolia, including the partial survival of peripherical Hittite administrative institutions (Mora and d'Alfonso 2012a).

The topic of the transition from the Hittite to the Post-Hittite period has received a renewed interest among scholars, as a result of the recent discovery of the Türkmen-Karahöyük inscriptions (Goedegebuure et al. 2020). I will discuss this latter epigraphic discovery in Section 3.3.2, as part of a more detailed overview of the transition from the Late Bronze and the Iron Ages in southcentral Anatolia.

- *The post-Hittite polities of Phrygia, Tabal, and Tuwana*

From the fragmented Early Iron Age political landscape, at least three main political powers emerged: the kingdom of Phrygia in western central Anatolia (Sams 2011), 'Tabal proper', and Tuwana in southcentral Anatolia (Hawkins 2000). The processes leading to the establishment of these polities, which are still not fully understood, are likely rooted in the Early Iron Age (e.g., d'Alfonso 2019). Nevertheless, it is with the beginning of the Middle Iron Age that these post-Hittite polities fully emerged in the historical sources, originating both from within and beyond the Anatolian Plateau.

In Neo-Assyrian sources, a large portion of the central Anatolian Plateau is referred to as the 'land of Tabal', a term that is generally understood to hold a geographic rather than political meaning, indicating the area covering the Konya Plain, Cappadocia, and the northern foothills of the central Taurus (Mora 2010: 17-19). The earliest Assyrian texts referring to Tabal date to the reign of Shalmaneser III: in 836 BCE the Assyrian king conducted a military campaign in central Anatolia, which resulted in the submission of the "24 Kings of the Land of Tabal" (Ebeling and Meissner 1938: 433-434). This latter passage could be taken as indicative of the presence in the Anatolian Plateau of a highly fragmented political landscape, perhaps centered on a constellation of city-states (Hawkins 2000: 426-427). It is from this hypothesized fragmented political landscape, that emerged the kingdoms of Tuwana and of 'Tabal proper'.

The kingdom of 'Tabal proper' likely stretched to the modern Turkish provinces of Kayseri and Nevşehir (e.g., Mora 2010: 17). In Assyrian sources dating to the reign of Sargon II, this polity was referred to as *Bit Burutaš* (e.g., Mora 2010: 17). A policy of direct Neo Assyrian intervention in Tabal affairs, including royal succession and appointment, is documented starting with the reign of Tiglath-Pileser III (Tadmor 1994: 170-171), from then continuing under Shalmaneser V and Sargon II (Hawkins 2000: 426-428). After the reign of Sargon II, Assyrian cuneiform sources only incidentally refer to Anatolia (Hawkins 2000: 426-428) and then become completely silent following the reign of Aššurbanipal (e.g., Luckenbill 1927: 296-197, 325, 352).

The kingdom of *Tuwana* is a second territorial polity documented in southcentral Anatolia during the Iron Age, which emerged as early as the 8th century BCE. This polity extended on the classical *Tyanitis* (southern Cappadocia), centered on the eponym city of *Tuwana* (Late Bronze Age *Tuwanuwa*, classical *Tyana*, modern Kemerhisar) (Bergens and Nollé 2000) (Chapter 3). The comparatively rich local Anatolian Hieroglyphic epigraphic record and Neo-Assyrian sources are particularly informative regarding the local king Warpalawas and his dynasty. Based on Assyrian sources, Warpalawas ruled for a particularly long reign, at least from 738 BCE (first appearance in tributary lists; Tadmor 1994: 68-69) to 710-709 BCE (mention of the king in a letter from Sargon II to the governor of Que; Parpola 1987: no. 1). Considering the volatile political scenario endemic of central Anatolia, Hawkins (2000: 432-433) hypothesized that the long-lasting reign of Warpalawas could have been favored by an alliance with the Neo-Assyrian Empire. In addition to Neo-Assyrian sources, the Tuwanean dynasty of Warpalawas is well-documented in the local corpus of Hieroglyphic inscriptions (Hawkins 2000). I will discuss these sources in Section 3.3.2, as part of the case study on the *Tyanitis*, which is included in Part II of the dissertation.

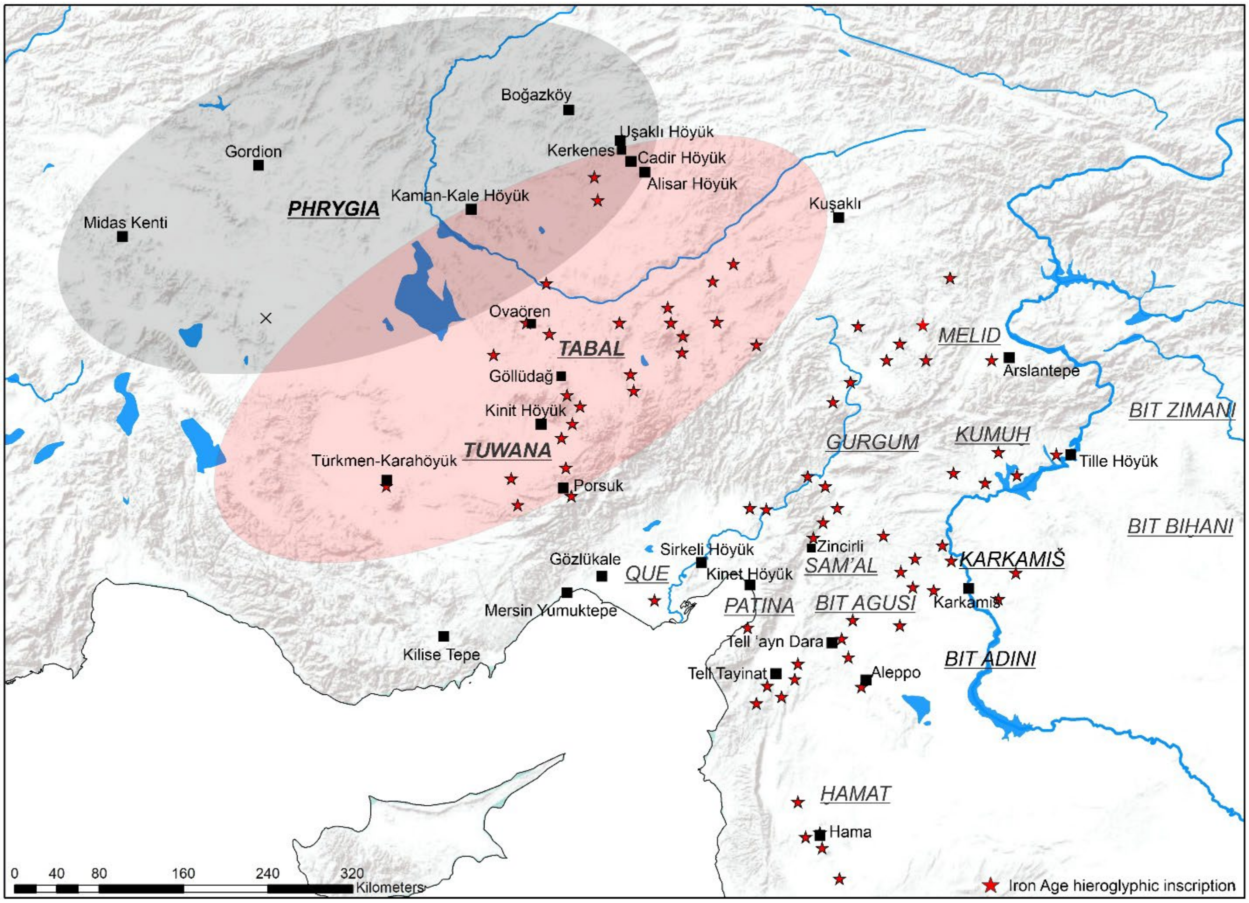

Boğazköy
Uşaklı Höyük
Kerkenes
Cadir Höyük
Alisar Höyük
Gordion
PHRYGIA
Kaman-Kale Höyük
Midas Kenti
Kuşaklı
Ovaören
TABAL
Göllüdağ
Kinit Höyük
TUWANA
Türkmen-Karahöyük
Porsuk
MELID
Arslantepe
BIT ZIMANI
GURGUM
KUMUH
Tille Höyük
BIT BIHANI
Sirkeli Höyük
Zincirli
SAM'AL
KARKAMIŠ
Gözlükale
QUE
Kinet Höyük
PATINA
BIT AGUSI
Karkamiš
Mersin Yumuktepe
Tell 'ayn Dara
BIT ADINI
Kilise Tepe
Tell Tayinat
Aleppo
HAMAT
Hama
0 40 80 160 240 320
Kilometers
Iron Age hieroglyphic inscription

Figure 1.13 – *Location of the main Iron Age sites discussed in the text. In the map it is indicated approximative extension of the Phrygian and Tabal domains. Stars indicates Iron Age Hieroglyphic Inscriptions, following* Payne 2012. *The main Iron Age polities are reported.*

The kingdom of Phrygia is the third main central Anatolian polity, emerging in the early 1^{st} millennium BCE. The central domain of Phrygia is located in the western portion of the plateau, in the upper Sakarya basin. The Phrygian capital city, Yassıhüyük-*Gordion*, has been investigated by a long-term archaeological project (Rose 2012, and references therein), which provide a reference archaeological sequence for the entire central Anatolian region.

According to a later Greek tradition, the Phrygians migrated into Anatolia from the Balkan Peninsula, where they were formerly known as *Bryges* (Sams 2011: 608, and references therein). A contribution of allochthonous groups to the ethnic makeup of the Phrygian population has been proposed by modern scholarship on the basis of two main lines of evidence: (*i*) the attestation in the Early Iron Age (Level YHSS 7 at Gordion) of a ceramic assemblage having comparanda in Thrace (Voigt and Henrickson 2000: 42-46; see however also Genz 2005); (ii) and an hypothesized closer affinity of the Phrygian language to Greek and Thracian, rather than other known Anatolian idioms (Roller 2011, and references therein). The earliest evidence of Phrygian writing dates to the mid-8th century BCE, using an early alphabetic script (Roller 2011). Hieroglyphic Anatolian, conversely, is not part of the Phrygian literacy and culture. It appears, thus, that a rather abrupt boundary was present, which could have been both political (Phrygia and Tabal) and ethnic-linguistic (Phrygian and Luwian) (Figure 1.13). These two main domains are, furthermore, characterized by distinctive ceramic productions, as I will briefly discuss below.

Starting with the 10th century BCE, two main ceramic traditions are documented in central Anatolia: (i) Gordion and the western sector of the plateau are associated with the distribution of a grey ware, which circulation has been associated to the establishment and later expansion of the Phrygian Kingdom (Sams 1994; Summers 1994); (ii) the coeval ceramic repertoire from south and southeastern central Anatolia is characterized by the production of dark-monochrome painted ware. This latter ceramic zone could be associated with the polity of Tabal (d'Alfonso et al. 2022). The boundary between these two ceramic traditions could be located along the Kızılırmak, and more to the south in proximity to the Tuz Gölü basin (Summers 1994, 2013). These two ceramic domains are, however, to be understood as a permeable interface, with comparatively widespread evidence of circulation of these ceramic types in both directions (d'Alfonso et al. 2022).

The emergence of the Phrygian Kingdom is closely associated with the history of its capital, Gordion (Rose 2012). At Gordion, both stratigraphic and radiocarbon evidence supports the presence of an unbroken occupation sequence, with a continuous occupation between the Early Iron Age (YHSS 7, 1150-900 BCE) and the Early Phrygian periods (YHSS 6, 900-800 BCE) (Kealhofer et al. 2019). On the basis of a new set of radiocarbon dates, Kealhofer et al. (2019) proposed that the transition from the small-scale EIA settlement (YHSS 7) to the monumental Early Phrygian citadel (YHSS 6A) occurred rather abruptly, possibly within a two-generation-time span. This phase of building activity is, furthermore, paralleled by the roughly coeval construction of at least six elite burial tumuli, starting at ca. 850 BCE (Kealhofer et al. 2019). The latter are an additional element of novelty in the central Anatolian landscape, which makes its first appearance at Gordion (e.g., Sams 2011).

In contrast to the Iron Age polities of southcentral Anatolia and northern Syria, there is a lack of both local and Assyrian accounts informing on Phrygian royal genealogies (Sams 2011). Greek sources frequently refer to the Phrygian king Midas, who is referred to as the son of Gordias (Sams 2011). A direct involvement of Midas in the Aegean cultural koine is well-exemplified by the tradition transmitted by Herodotus (Histories, I.14) of the Phrygian king being the first non-Greek person to have provided an offer at the sanctuary of Apollo at Delphi. The reign of Midas could be dated to the final decades of the 8th century BCE, based on its mention (as Mita of *Muški*) in the annals of Sargon II for the years between 718 and 709 BCE. According to a later the Greek tradition, Midas died during the Cimmerian invasion in the early 7th century BCE (Sams 2011). It is likely that Midas was a dynastic name (e.g., d'Alfonso 2019), with the possible presence of more than one ruler bearing the same regnal name.

- *Lydians, Medians, and Persian in Late Iron Age central Anatolia*

Military incursions of Cimmerians throughout the entire 7th century BCE are documented in both Assyrian and later Greek sources. These hostile activities culminated in the destruction of the Lydian capital of Sardis and the death of its king (Gyges) (Sams 2011).

Lydia emerged as the main power in western Anatolia in the 7th and 6th centuries BCE, expanding by the early 6th century its hegemony across part of the Anatolian Plateau, including Phrygia (Roosevelt 2009, Payne and Wintjes 2016). According to a Greek tradition transmitted by Herodotus, Gordion remained a wealthy city also under Lydian hegemony. Abundant archaeological evidence, including coins and ceramics, support the strength of Lydian influence during this later phase of the Middle Phrygian Period. Of particular note is the atypical concentration of Lydian ceramics at Küçük Höyük, a small hill sitting a short distance from the citadel of Gordion, which has led to hypothesize the presence of a Lydian garrison (Sams 2011: 615, and references therein).

The Medes are a second political power attested in central Anatolia during the Late Iron Age (Sams 2011). This group, of western Iranian origin, in coalition with Babylonians put to an end the Neo-Assyrian Empire in the late 7th century BCE. The Median domain soon expanded, likely including the portion of central Anatolia to the east of the Kızılırmak River (e.g., Tuplin 2004). The rising power of Persia, under the lead of Cyrus the Great, soon also incorporated the Median territories in Anatolia. It is within this context that, in the mid-6th century, the war between the Lydian kings Croesus and Cyrus the Great culminated in the fall of Sardis, in 547 BCE, which ultimately led to the inclusion of the entire Asia Minor Peninsula in the domain of the rising Persian Empire.

As an opposing situation from that of western Anatolia, very little information is available for the Late Iron Age in the region formerly at the center of the post-Hittite polities of Tabal and Tuwana. This lacuna of data is due to an almost complete dearth of documentary sources, due to the end of the local Anatolian Hieroglyphic tradition (Hawkins 2000: 433), which is coupled by the silence of Neo-Assyrian sources (Hawkins 2000: 428). More remote and detached from the Aegean world, this region is also only occasionally referred to in Greek sources covering the pre-Classical periods. These limits, exacerbated by a far from satisfactory archaeological record, make it highly problematic to outline the historical trajectory of this region prior to its incorporation into the Persian Empire.

1.2.5 Achaemenid satrapies in central Anatolia

From the fall of Sardis (547 BCE) and until the Asian campaign of Alexander the Great (333 BCE), central Anatolia remained under Persian control (Dusinberre 2013). The subjugation of Asia Minor by Cyrus the Great has been traditionally associated with several destruction levels attested in various centers of regional importance, including the Lydian capital of Sardis (e.g., Cahlil 2019: 18-20, and references therein), the city of Daskyleion in the Propontis (Iren 2010), the Late Phrygian site of Kerkenes Dağ (e.g., Summers 1997), and of the Küçük Höyük fortress on the outskirts of Gordion (e.g., Roller 2011). The following two centuries of Persian rule in Anatolia remain, nevertheless, comparatively poorly understood, both archaeologically and historically. The Greco-Roman authors represent the main source on this phase of Anatolia history (Herodotus *Histories*: 1, Xenophon, *Anabasis*, Cornelius Nepos, *Datames*). It is accordingly far from surprising that their accounts inform on central Anatolian matters only in the few instances in which they intercept eastern Mediterranean affairs (Dusinberre 2013: 36-37 and therein references).

Following the administrative organization of the Persian Empire, the Achaemenid domains in Anatolia were divided into provinces (satrapies), which were under the control of a provincial ruler (satrap). The main task of the satrap, who with only a few exceptions was of Iranian origin, was to collect the tribute and to transmit it to Susa. Following the Persian conquest, Asia Minor was accordingly reorganized into satrapies, which included: Armenia, Cappadocia, Hellespontine Phrygia, Greater Phrygia, Lydia, Caria, Lycia, and Cilicia (Dusinberre 2013: 33).

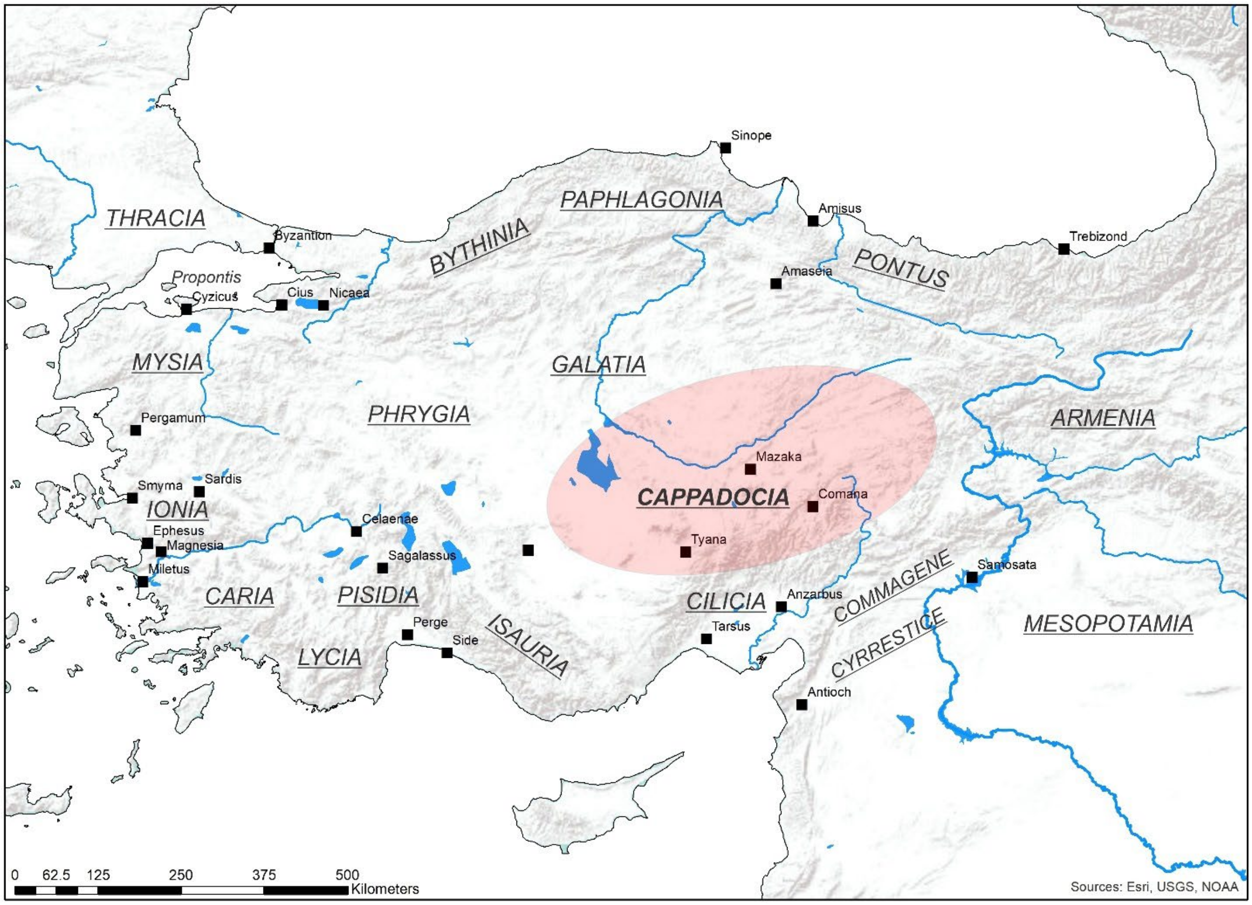
The central Anatolia Plateau was, thus, included in two distinct satrapies, Greater Phrygia to the west and Cappadocia to the south and east. The latter, the satrapy of *Katpatuka*, stretched over a large portion of central Anatolia, from the Taurus range to the Black Sea coast (Strabo, Geography: 12.1-2). According to a tradition transmitted by Strabo, at a later stage, *Katpatuka* was divided into two provinces, “Cappadocia Pontica” in the north, and “Cappadocia near the Taurus” in the south (Strabo, Geography: 12.1.2). The capital of the satrapy was *Mazaka*-Kayseri, which was located on a strategic position along the Persian ‘Royal Road’, which connected Sardis with Susa. *Celaenae* was the provincial capital of the Satrapy of greater Phrygia, a site identified with modern Dinar, at the sources of the

Maeander River (Roller 2011). Our archaeological knowledge of these provincial centers is extremely limited. This lack of data could be, in part, supplemented by the more extensive architectural and administrative evidence available from other Asia Minor sites – most notably at Daskyleio*n*, the capital of Hellespontine Phrygia, in the Marmara region (Kaptan 2002, Abe 2012).

1.2.6 The Hellenistic Period in central Anatolia

In the spring of the 334 BCE, Alexander the Great crossed the Dardanelles and started his march that soon after led to the conquest of Asia (Arrian, *Anabasis*: I.11). Following a first victory against the Persian army (Battle of Granicus), Alexander and his troops marched counterclockwise across the Anatolian Peninsula. After sizing Sardis, Ephesus, Miletus, and Halicarnassus (*Anabasis*: I.20-23), the Macedonian army crossed Lycia and Pamphylia (*Anabasis*: I.24-26), for there reaching Phrygia and the city of Gordion, where Alexander famously untied the Gordian knot (*Anabasis*: II.3). From Gordion, Alexander reached Cappadocia (*Anabasis*: II.4), for the crossing the Cilicia Gates (*Anabasis*: II.5), and defeating Darius III, near the site of *Issus* (Kinet Hoyük) (*Anabasis*: II.10). With the battle of Issus (333 BCE), the entire Anatolia is under the control of the Macedonian prince.

After the death of Alexander, during the "Partition of Babylon" (323 BCE), what was the Achaemenid satrapy of Cappadocia and Paphlagonia were reassigned to Eumenes of Cardia. However, according to a tradition transmitted by Diodorus Siculus (*Library of History*, XXXI: 19), in Cappadocia the rulership of Eumenes of Cardia was soon challenged by a local dynasty of self-proclaimed Iranian heritage, descending from the former satraps. Under these rulers, the Ariarathids, Cappadocia maintained *de facto* an independent status. With the reign of Ariarathes III (225-220 BCE), the Kingdom of Cappadocia self-proclaimed its political independence (Panichi 2018: 13), which will last until the formal annexation of the Kingdom of Cappadocia under the Roman Empire, at the end of the reign of Archelaos, in the year 17 CE (Berges and Nolle 2000: 487-488). A more detailed account of the history of the Hellenistic Kingdom of Cappadocia is provided in Section 3.3.4. To the north of Cappadocia, the Kingdom of Pontus represented a second self-proclaimed independent reign ruled by a local dynasty (the Mithridatic) claiming a Persian origin. This kingdom is most notably associated to Mithridates VI Eupator (r. 120-63 BCE) (Højte 2009).


Sinope
PAPHLAGONIA
Amisus
THRACIA
Byzantion
BYTHINIA
Trebizond
Propontis
Cyzicus
Cius
Nicaea
Amaseia
PONTUS
MYSIA
GALATIA
PHRYGIA
Pergamum
ARMENIA
Mazaka
Sardis
Smyrna
IONIA
CAPPADOCIA
Comana
Celaenae
Ephesus
Magnesia
Tyana
Sagalassus
Samosata
Miletus
CARIA
PISIDIA
CILICIA
Anzarbus
COMMAGENE
Perge
Side
ISAURIA
Tarsus
MESOPOTAMIA
LYCIA
CYRRESTICE
Antioch
0 62.5 125 250 375 500
Kilometers

Sources: Esri, USGS, NOAA

Figure 1.14 – *Hellenistic Asia Minor: main historical regional toponyms and selection of important sites. An approximative extension of the Kingdom of Cappadocia is provided.*

At the "Partition of Babylon", the western and northwestern sectors of the Anatolian Plateau, the former satrapy of Greater Phrygia, became part of the Seleucid domain. The ethnic and cultural layout of the region was, however, shortly thereafter impacted by the settlement, in part of Phrygia and of the region later to be known as Galatia, by La Tène Celtic tribes from Europe ("Galatians"), who entered Anatolia *en masse*, recruited as mercenaries by Nichomedes of Bythinia (Mitchell 1993, 19-20). These tribes settled in northern and western central Anatolia, including the site of Gordion (Voigt 2003). According to the Greco-Roman sources, the Galatians took part in several military activities within and beyond the Anatolian Plateau, either plundering the nearby regions or at the service of the local Hellenistic rulers. For the purposes of this introduction, the settlement of the Galatians in the plateau represents yet another phase in the eventful central Anatolian historical and cultural trajectory.

1.3 Summary

Chapter 1 introduced to the geographic and historical contexts covered by the dissertation project. In Section 1.1, the physical geography of the Anatolian Peninsula was discussed, with a specific focus on the Anatolian Plateau (Section 1.1.1). The latter region is characterized by a semi-arid continental climate. Low precipitation levels are associated with an orographic effect, determined by the Pontus and Taurus mountain chains, which surround the central region of Anatolia. A large portion of central Anatolia is endorheic, without having any outflow to a sea. This hydrographic setting is associated to the formation of terminal lakes and various humid environments, often highly saline due to the high evapotranspiration. Climate, pedology, and geomorphology directly impact the distribution of woodlands, which are, to date, limited to the mountain slopes present in the fringes and at the center of the region. The extension and distribution of forests in central Anatolia is, however, strongly impacted by a long-term anthropogenic pressure on these environments. The second part of the chapter, Section 1.2, introduced to the history and archaeology of central Anatolia, focusing on the period comprising the Early Bronze Age and the end of the Hellenistic kingdoms. The Early Bronze Age (Section 1.2.1) is discussed in relation to the emergence in central Anatolia of complex societies. These processes will further culminate in the Middle Bronze Age, a phase characterized by the presence of local principalities and the incorporation of central Anatolia in a long-distance trade network (Section 1.2.2). From the fragmented political landscape of the Middle Bronze Age, in the 17th century emerged the Hittite Kingdom (Section 1.2.3). The discussion of the Iron Age period (Section 1.2.4) was centered on three main phases: the aftermath of the Hittite Empire; the establishment of the polities of Phrygia, Tabal, and Tuwana; and the Late Iron Age hegemony of external powers over central Anatolia. Finally, I discussed the Achaemenid (Section 1.2.5) and Hellenistic periods (Section 1.2.6).

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Given the specificities in local environmental conditions and the fluidity in the local and regional history, I will pose the question of how local agricultural traditions changed through time. I will also explore the question of which structural aspects define farming systems in the long-duree. A first step towards answering these questions is to systematically review the evidence informing on ancient agriculture, which will be the focus of the next chapter.

CHAPTER 2

Agriculture in ancient central Anatolia: sources and topics

The aim of this chapter is to provide an overview of the available sources that relate to ancient agriculture in central Anatolia, covering the period from the beginning of the Bronze Age (ca. 3000 BCE) to the incorporation of Asia Minor under Roman rule (1st century CE).

The study of the history of agriculture requires a multidisciplinary approach. Direct evidence for past agricultural practices is found in the material record preserved in both natural and archaeological deposits, encompassing ecofacts, artifacts, and structures. Textual sources can complement the available material evidence – illuminating, among several other aspects, the organization of agricultural production within the broader socio-economic system in which these activities were embedded.

This dissertation will be, accordingly, based on four main sets of evidence: (*i*) archaeological evidence, with a particular emphasis given to agricultural infrastructures; (*ii*) archaeobotanical macro-remains – i.e., wood charcoal and seed/fruit remains from archeological contexts (Section 2.1); (*iii*) palynological sequences originating from off-site (limnic) deposits (Section 2.2); and (*iv*) textual sources, which directly or indirectly inform on agricultural matters (Section 2.3).

In this chapter, I will provide a concise introduction to the archaeobotanical, palynological, and textual evidence on ancient agriculture. A general methodological overview will be followed by a systematic review of the respective datasets currently available from the Anatolian Peninsula. Because of space and time constraints, I will do not include in this overview a detailed analysis of the archaeological evidence of agricultural infrastructures. The latter will be discussed in other chapters, with particular attention given to large-scale storage (Chapters 4 and 7) and water management (Chapter 7).

2.1 The archaeobotanical record: seed/fruit remains and wood charcoal

Botanical remains preserved in archaeological deposits can directly inform on the activities involving plant materials that were conducted at a given site (e.g., crop processing, storage, cooking, heating, and more in general pyrotechnological processes), the associated practices taking place in the broader landscape (e.g., farming, wild resources exploitation, firewood collection), and the wild and ruderal flora therein present. This type of evidence is, accordingly, of central importance in the dissertation project.

Archaeobotanical records are commonly classified into botanical micro- (pollen and palynomorphs, micro-charcoal, phytoliths, and starch grains) and macro- (seed/fruit, macroscopic wood charcoal, wood) remains (Pearsall 2015). In this section, I will concentrate on the latter. In the following paragraphs, I will provide a brief methodological introduction to carpological (seed/fruit) and anthracological (wood charcoal) analysis (Section 2.1.1), which will be followed by a concise history of archaeobotanical research in Anatolia (Section 2.1.2). Finally, I will conclude with a systematic literature survey of the published carpological (Section 2.1.3) and anthracological (Section 2.1.4) evidence from the Anatolian Peninsula (modern Turkey). Fossil pollen records from off-site (limnic) sequences are discussed in Section 2.2.

2.1.1 *Archaeobotany: methods, questions, limits*

Archaeobotanical methods and theories are well-covered in several excellent publications. The volume edited by Marston and colleagues (2014) and the latest edition of Pearsall's seminal handbook (2015) provide the most up-to-date methodological surveys of the field, which complement and update previous overviews (e.g., Renfrew 1973, Hastorf and Popper 1988, Greig 1989). Given the breadth of the topic, it is surely out of the scope of this dissertation to include an exhaustive introduction to this field of research. Leaving to the aforementioned literature this task, in the following paragraphs, I will provide a brief overview of the main methodological foundations of archaeobotanical research. In addition to providing a due introduction, this section is aimed to lay out the methodological framework under which archaeobotanical evidence will be interpreted throughout the dissertation – including both published (Sections 2.1.3 and 2.1.4) and original (Chapters 5 and 6) datasets.

- *Carpology: the study of seed and fruit remains*

Seeds and fruits are commonly found in archaeological deposits, representing, together with wood charcoal, the most common type of archaeobotanical macro-remain therein present.[1] Renfrew (1973: 1-6) and Pearsall (2015: 28-30) provide an overview of the history of carpological research, which is here only briefly summarized. The first studies of seed/fruit remains from archaeological contexts occurred in the mid-19th century, in connection with the recovery of exceptionally well-preserved specimens in favorable depositional environments (Renfrew 1973: 1-6, Pearsall 2015: 28-30). In 1853/54, a particularly dry and cold winter caused the sudden lowering of several Alpine lakes, which in turn exposed submerged pile-dwelling sites located on the Swiss Plateau (Keller 1866). The anoxic depositional environment, which is characteristic of waterlogged deposits (Jacomet 2013), provided optimal preservation conditions for the rich subfossil plant macro-remain assemblages associated with these prehistoric settlements, which, in turn, prompted the first systematic study of this type of evidence in Europe (Heer 1866). A somehow parallel and independent tradition of early archaeobotanical research stemmed from the study of desiccated plant assemblages from hyper-arid environments. This latter avenue of pioneering research was first conducted on materials sampled from funerary contexts in Egypt (e.g., Kunth 1826) and Peru (e.g., Saffray 1876, Wittmack 1888). The beginning of archaeobotany is, thus, connected to two specific modalities of preservation of botanical remains: via desiccation and waterlogging. In both instances plant tissues were generally preserved in optimal conditions, a factor that very likely favored and facilitated an early interest in the study of these remains.

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[1] The terms 'seed' and 'fruit' are often misused in non-specialistic contexts: one-seeded, indehiscent, dry fruits are frequently wrongly referred as 'seeds' – such is the case of achenes, nutlets, and caryopses (Cappers and Bekker 2013).

Plant materials, like most organic matter, undergo decomposition. Microorganisms, such as soil-based bacteria and saprophytic fungi, are the primary agents causing the decay of plant tissues. Decomposition is further accelerated and enhanced by invertebrates (e.g., earthworms and insects) and geochemical processes (Ford 1979, Greenwood 1981, Gallagher 2014: 20, Pearsall 2015: 40-44). Given this premise, the preservation of plant remains in the archaeological record necessitates that the process of organic decay is either inhibited or slowed. The different modalities under which these latter conditions can occur are referred as 'modes of preservation' (Gallagher 2014, and references therein).

The brief digression made at the beginning of this section into early archaeobotanical research allows me to introduce two examples of preservation modes: dry and wet preservation. In both instances, the partial inhibition of the decomposition process depends on the presence of specific environmental conditions in the burial context. Wet preservation is associated with submerged or waterlogged deposits (Menotti 2012), favoring anoxic conditions, which in turn inhibit the presence of aerobic microorganism and other common decomposing agents (Caple and Dungworth 1997).[2] Under such conditions, plant materials are preserved in a fairly unaltered state, which are then generally referred to as subfossils (Jacomet 2013). Plant tissues can preserve also in hyper-arid environments. Organic decay in these latter instances is inhibited by a sustained absence of moisture, which limits the growth of microorganisms responsible of the decomposition process (van der Veen 2007). Apart from an expected shrinking, due to moisture-loss, desiccated plant remains are expected to be optimally preserved (van der Veen 2007).

Dry and wet preservation necessitates the presence of specific environmental conditions in the burial context – either saturated with water or deprived of humidity. A completely different set of preservational processes include charring and mineralization, which function based on a chemical transformation of the degradable plant tissues into stable compounds. In these cases, preservation can occur regardless of the specific depositional and post-depositional conditions. The process of mineralization consists of the replacement of organic components in plant tissues by exogenous mineral structures (Gallagher 2014: 25). This process is promoted either by particular properties of the embedding sediment (e.g., phosphate-rich contexts, such as are most commonly present in latrines)

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[2] The preservation of plant materials in marine deposits is not discussed in this context. For further information, I refer the reader to the overview provided by Gregory and Matthiesen 2018.

(McCobb et al. 2001) or by the physical proximity of the plant tissue to an oxidizing metal (e.g., Moulherat et al. 2012). Some plant taxa, furthermore, produce diaspores containing concentrations of mineral substances (carbonate or silica), which promote their preservation. This process is referred to in the literature as bio-mineralization (Messager et al. 2010). In western Asian sites, common biomineralized carpological finds include nutlets of several species in the Boraginaceae family (e.g., Pustovoytov et al. 2004), hackberry (*Celtis* sp.) endocarps, (e.g., van Zeist and de Roller 2003: 183), and achenes of various sedges (Cyperaceae family). As discussed by Pustovoytov and colleagues (2004), the dating of these remains is often challenging, considering the difficulty in distinguishing between remains deposited as part of the archaeological occupation from later (either ancient or modern) intrusive materials.

Charring is, by far, the most ubiquitous and common preservation mode of archaeological plant materials, a predominance of which reflects the generalized central importance of pyrotechnological activities in the daily life of ancient human communities. The process of charring consists of the conversion of degradable organic compounds into carbon-based inorganic structures (Braadbaart and Poole 2008). The resulting charred plant tissues are almost inert to bacterial, fungal, and insect decomposition. Thus, having a high-preservation potential regardless of depositional and post-depositional environments, with the main and partial exception of high-alkaline sediments (Braadbaart et al. 2009). Charred plant materials originate from their exposure to a heating source, under a limited (properly 'charring') or absent ('carbonization') supply of oxygen (Braadbaart and Poole 2008). In the literature, 'charring' and 'carbonization' are often used as interchangeable terms; throughout the dissertation, I will use the term "charring" under this more generic meaning, indicating the preservation of plant tissues by means of charcoalification, regardless of the firing atmosphere.

On an empirical basis, an ideal preservation through charring occurs when fire temperatures range between 250 – 500 °C (e.g., Boardman and Jones 1990). Plant materials exposed to higher temperatures, conversely, are generally fully reduced to ashes – i.e., the mineral residue resulting from the complete vaporization of carbon, hydrogen, and oxygen present in plant tissues (e.g., Canti and Brochier 2017). The range of temperature previously provided are to be considered purely indicative. A number of variables are, in fact, involved in the charcoalification process, such as the conditions at burning of the plant material (e.g., its moisture content), the specific properties of the combustion environment (e.g., the level of oxygen), and the length of exposure to fire. Given the same firing conditions, furthermore, different morphological changes are expected to occur to different plant parts or taxa, depending on both density and chemical properties. Most notably, in cereals important variations are observed between chaff and grains, with the latter that generally withstand significantly higher temperatures (Boardman and Jones 1990). In addition to weight loss (e.g., Ferrio et al. 2004), plant parts exposed to charring undergo morphometric changes (Pearsall 2015: 40-44). A comparatively large body of literature exists on this latter topic, including experimental charring studies conducted on wheat (e.g., Braadbaart et al. 2005, Braadbaart 2008), legumes (e.g., Braadbaart et al. 2004), millet (e.g., Walsh 2017), grapes (e.g., Logothetis 1970, 1974, Smith and Jones 1990), and a miscellaneous assemblage of other crops (e.g., Wright 2003, Märkle and Rösch 2008).

Given the centrality of fire and firing activities in the formation of the archaeobotanical record, a brief discussion of these processes is needed. In archaeological contexts, fire episodes can be schematically classified into two main types of events: conflagration episodes and activity fires (van der Veen 2007). Conflagrations, of various scale and intensity, result in the exposure to fire of the entire plant assemblage present in the context by a single event, regardless of the uses and pre-depositional processes in which they were involved. Activity fires, conversely, are connected to specific activities (e.g., heating, firing, crop processing, and food production), during which plant materials could be exposed to the fire, either purposely or accidentally (van der Veen 2007). As noted by van der Veen (2007), in charred archaeobotanical assemblages resulting from activity fires, only a portion of the original 'plant culture' is expected to 'fossilize' in the archaeological record: several fruit crops, tubers, condiments, and vegetables are likely to be either unattested or strongly underrepresented, due to a lower probability of these plant materials being exposed to fire as part of the routine activities in which they were involved (e.g., during processing, preparation, and consumption). It is, thus, safe to argue that in a carpological charred record originating from activity fires only a fraction of the plant materials originally occurring at a given site should be expected to be attested (van der Veen 2007). Vegetables, herbs, tubers, bulbs, spices, and most fruit crops are, accordingly, systematically underrepresented in the archaeobotanical record, despite the expected centrality of these products in the Ancient World.

Having introduced to the main preservation modes of archaeobotanical remains, in the following paragraphs, I will briefly discuss the formation processes of the carpological record (e.g., Ford 1979, Minnis 1981, Hillman 1981, 1984b, 1985, Jones 1981, 1987, van der Veen 2007, Filipovic 2014: 65-71, with further references). In a seminal publication, Minnis (1981) proposed to classify the depositional processes of carpological remains into three main pathways: (*i*) direct anthropogenic deposition, indicating the instances in which the deposited seeds/fruits have been purposely brought to the site for intentional use; (*ii*) indirect anthropic deposition, representing the occurrences in which the deposited plant materials were unintentionally brought to the site; and (*iii*) non-anthropic deposition, in which the depositional vector is either an animal (e.g., rodents), atmospheric (e.g., 'seed rain'), or any other non-human agent. With the notable exception of waterlogged sites, there is large agreement within scholarship that recognizes only a limited and localized contribution to the formation of the archaeobotanical record of non-anthropic depositional pathways (e.g., Filipovic 2014: 65). Either directly or indirectly, human activities are, thus, generally regarded as the main depositional vector of plant materials within human settlements. The most common instances of direct anthropogenic deposition are connected to the economic exploitation and use of crops (e.g., for food and fodder) or of their by-products (e.g., for fuel, fodder, bedding, and thatching) (e.g., Jones 1988, van der Veen 2007, Filipovic 2014: 65, and references therein), and of wild plant resources present in the landscape (e.g., for food, fodder, fuel, medical or recreational use, building, matting, basketry, and decoration) (Ertuğ 2000, 2004, 2006). In western Asian sites, indirect anthropic deposition is most notably associated to the use of ruminant dung as fuel (Miller 1984, Miller and Smart 1984, Anderson and Ertuğ-Yaraş 1998, Charles 1998).

In light of the importance of human behaviors to the formation of the carpological record, middle-range theories have traditionally held a centrality in archaeobotanical scholarship. On the basis of ethnographic observations (e.g., Hillman 1981, 1984a, Jones 1983, 1984, 1987, Peña-Chocarro 1999, D'Andrea and Haile 2002, Margaritis and Jones 2006), these models ultimately aim to map archaeobotanical assemblages onto the underlying human activities that determined their formation (Jones 1990, Margaritis and Jones 2006, van der Veen and Jones 2006). Of pivotal importance is the study of traditional cereal farming and processing conducted by Gordon Hillman in Turkey (e.g., 1981, 1984a) and Glynis Jones (e.g., 1984, 1987) in Greece.

The goal of cereal processing is to separate the crop (either the clean grains or the glumed spikelets) from the by-products of the harvest (weeds, chaff, and straw).[3] This task is achieved by exploiting the differences in the physical properties (weight, size, toughness, and aerodynamics) between the different plant parts that are processed. The physical properties of these plant parts explains their recurrent appearance in different socio-cultural contexts of the same *chaîne opératoire*. More specifically, three subsequent steps are assumed to be involved in domesticated cereal processing, regardless of where or when: (*i*) threshing, which consists in freeing the spikelets from the outer chaff and straw, commonly achieved by subjecting the sheaves to mechanical stress (e.g., trampling or beating); (*ii*) winnowing, which consists in a first separation of the different plant parts that have been loosen form their glumes by threshing, taking advantage on their differences in weight and aerodynamic properties; and (*iii*) sifting, which allows to further clean the product, excluding the plant parts that are either larger (coarse sieving) or smaller (fine sieving) than the final product of interest. Part of this process could be conducted more than once, commonly including, for instance, secondary threshing and winnowing. Furthermore, additional steps can be added to this general *chaîne opératoire*, depending on the type of crop processed (e.g., hulled cereals requiring dehusking), the socio-economic context (e.g., scale of production, labor, and technology), and the planned modality of storage/use (e.g., spikelet or clean grain storage) (e.g., Hillman 1981, 1984a, Jones 1983, 1984, 1987, Peña-Chocarro 1999,

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[3] In traditional systems, crop processing by products are of economic importance in traditional western Asia farming systems. An overview on this topic is provided by van der Veen 1999.

D'Andrea and Haile 2002). It is crucial to note that each step in this process produces a comparatively predictable association of products and by-products, which allows to tentatively identify the different stages of cereal processing in archaeological contexts on the basis of the archaeobotanical record (Jones 1987, 1990, van der Veen and Jones 2006). Although a traditional focus in archaeobotanical literature has been given to cereal processing, given their centrality in human economies, in more recent years similar models have been developed for other crops, such as grapes (Margaritis and Jones 2006) and pulses (Fuller and Harvey 2006).

As previously noted, the use of ruminant dung as fuel potentially represents an additional prominent depositional pathway contributing to the formation of carpological assemblages (e.g., Miller and Smart 1984, Spengler 2019). The practice of dung burning is ethnographically well-documented throughout western Asia (Miller 1984, Ertuğ-Yaraş 1997, Anderson and Ertuğ-Yaraş 1998, Charles 1998, Reddy 1998) and elsewhere (e.g., Wood and Baldwin 1985). Experimental studies have confirmed that a significant fraction of the botanical remains ingested by ruminants survives digestion and subsequent burning of dung cakes, although with a selective overrepresentation of small diaspores having a thick seedcoat/pericarp over larger seeds/fruits and chaff (Russi et al. 1992, Valamoti and Charles 2005, Wallace and Charles 2013).

If the presence of a degree of dung-burning in western Asian economies is well documented, more controversial is the identification of this practice in the archaeobotanical record, as well as a quantitative evaluation of its contribution to the formation of the assemblage (e.g., Spengler 2019, and references therein). The ethnoarchaeological study conducted by Miller and Smart (1984) resulted in the proposal of four main criteria for identifying dung-burning: (*i*) the scarcity of wood fragments in the assemblage and of wood resources in the vegetation community around the site; (*ii*) the presence in the local economy of suitable dung-producing ruminants; (*iii*) the identification of charred dung pellets or of seeds/fruits potentially originating from fodder/forage; (*iv*) and the presence of dung pellets/fodder taxa in association to fire installations. The seminal publication of Miller and Smart (1984) prompted an animated debate in the archaeobotanical scholarship, which ultimately culminated in Charles (1998) proposal to further restrict the criteria to be use in order to identify dung burning in the archaeobotanical record, namely: (*i*) the presence of a distinctive wild/weed assemblage that differs from the expected by-products of crop processing, and (*ii*) the presence of mixtures of crops/crop by-products that are unknown ethnographically to have been grown and/or processed together (e.g., hulled and free-threshing wheat). Finally, following a complementary quantitative approach, the ratio between wood charcoal and seed/fruit remains (e.g., Miller and Marston 2012) has been proposed as an effective empirical criterion to estimate the contribution of dung burning to the firing activities.

In recent years, the study of archaeological dung-burning has benefited from multidisciplinary approaches to research, which includes an integrated analysis of botanical macro-remains, micro-remains (Fuks and Dunseth 2019), and geo-chemical proxies (Smith et al. 2019). These developments are part of a broader trend in archaeobotany, which is progressively redefining the field following the inclusion of new methodologies and techniques. Among these recent developments, it is worth mentioning, for example, the progress conducted on aDNA (e.g., Brown et al. 2015, Latorre et al. 2020), and on stable isotope analyses of botanical remains (e.g., Masi et al. 2013a, 2013b, 2014, Riehl et al. 2014, Araus et al. 2014, Fiorentino et al. 2015, Stroud 2016, Vignola et al. 2017, 2018, Diffey et al. 2020)

- *Anthracology: the study of wood charcoal*

Wood was a central resource in pre-modern economies, a raw material systematically exploited for construction, manufacture, heating, lighting, cooking, and pyrotechnological activities (e.g., Perlin 2005). In light of the economic centrality of fire and wood in daily life among ancient communities, it is far from surprising that wood charcoal is one of the most ubiquitous and abundant components of archaeological deposits. Anthracology is the subfield of archaeobotany that specializes on the quantitative study of macroscopic wood charcoal, an evidence that could inform on: (*i*) the activities in which wood was used, that, in turn, illuminates on the underlying practices and behaviors (e.g., Marston 2017: 61-63); and (*ii*) on the woody vegetation present in the environs of the archaeological site (e.g., Chabal 1992, Kabukcu and Chabal 2021).

Anthracology is a comparatively young field (e.g., Kabukcu 2018a: 133-134). At the onset of archaeobotanical research, in the second half of the 19th century, wood charcoal analysis was limited to the botanical identification of single specimens (e.g., Heer 1866). The first quantitative studies of wood charcoal were conducted in the mid-20th century, following the pioneering work of Salisbury and Jane (1940) in southwestern England. These authors also provided the first attempt at using wood charcoal to reconstruct past vegetation history –which prompted an animated debate in the scholarship. Critiques were in particular centered the hypothesized presence of cultural (e.g., firewood selection) and taphonomic (e.g., fragmentation) filters, which would cause wood charcoal data to be unreliable for quantitative analysis (e.g., Godwin and Tansley 1941). The soon to be developed anthracological theory will be explicitly directed toward properly addressing this critique, as I will further discuss bellow.

In the 1960s, two key technological innovations played a fundamental role in the establishment of modern anthracology: episcopic microscopy and machine-assisted flotation. In the early scholarship, wood charcoal specimens were analyzed using traditional transmitted light microscopy, a technique which requires a time-consuming preparation of specimens to obtain thin sections (e.g., Momot 1955). The adoption of episcopic (reflected light) microscopy provided the possibility to observe the surface of tridimensional specimens, which allows to limit preparations to a manual exposure, through fracture, of the fundamental wood sections on the charcoal fragment under analysis (Western 1971, Leney and Casteel 1975). The deployment of more effective analytical protocols and methods was coupled by an exponential increase in the number of available specimens, as a consequence of the adoption and subsequence widespread use of the flotation method (Struever 1968). These technical developments were complemented by an intensive phase of methodological and theoretical elaboration, which ultimately promoted the formulation of the main methodological and theoretical assumptions defining modern anthracology (Vernet 1973).

Of crucial importance to the establishment and development of anthracology has been the so-called "Montpellier School": a group of scholars based at the University of Montpellier and working under the mentorship of Jean-Louise Vernet (Kabukcu and Chabal 2021: 6). This formative phase of the field reached momentum with the organization of the 1st International Anthracology Meeting, the proceedings of which offered the first cohesive assessment of methods and theories in wood charcoal analysis (Vernet 1992). In the English literature, the main formulations of the "Montpellier School" were presented by Asouti and Austin (2005), and more recently summarized by Kabukcu (2018) and Kabukcu and Chabal (2021). The aforementioned literature provides a more detailed discussion; in the following paragraphs, I will summarize the main assumptions of anthracological theory.

The approach formulated by the "Montpellier School" (Chabal 1988, 1992), and currently adopted by most scholars in the field (Asouti and Austin 2005, Kabukcu and Chabal 2021), strongly relies on a proper understanding of the taphonomic processes leading to the formation of the wood charcoal assemblage, including in such analysis the pre-depositional, depositional, and post-depositional processes. Particular importance is given to (*i*) the type of activity the wooden resources were used for and (*ii*) the duration of the depositional processes, as I will discuss below.

In pre-modern economies, wood is used for a number of activities – e.g., construction, manufacture, and pyrotechnological activities (domestic and artisan) (Perlin 2005). Based on the specific intended use, some taxa could be, thus, favored over others, because of species-specific properties (Asouti and Austin 2005, Marston 2013). In timber, for example, a significant degree of selection could be assumed, with certain taxa being potentially favored over others based on dimension, mechanical properties, and durability. Conversely, it has been argued (Chabal 1992, Kabukcu and Chabal 2021, with previous literature) that the collection of firewood for domestic purposes is largely determined by the Principle of Least Effort (Zipf 1949), rather than by preferences dictated by species-specific variables (e.g., differences in calorific value). As recently summarized by Kabukcu and Chabal (2021: 13), this assumption is based on three main observations: (*i*) the calorific value of wood is in large part determined by its physical condition at the time of use (green, dry, or seasoned) rather than by taxon-specific proprieties; (*ii*) the height of the flames and the duration of combustion are to a large extent associated to the diameter of the firewood used; and (*iii*) the overall quality of the fire is strongly influenced by the arrangement of the fuel and the pyrotechnological structure. By assuming that firewood collection strategies are chiefly based on the Principe of Last Effort, it would follow that: (*i*) firewood is collected in the landscape surrounding the site, and (*ii*) the woody taxa therein available are collected in proportion to their availability/accessibility (Chabal 1992).

Following a more general post-processual approach to scholarship, more recently, it has been argued for the presence of culturally driven firewood preferences, which are to be factored in the interpretation of wood charcoal evidence. Selection can, in fact, be dictated by perceived rather than factual differences in firing quality. Furthermore, non-functional preferences or tabus embedded in the specific cultural context are to be acknowledged (Picornell et al. 2011, Henry 2011, Kabukcu 2018a: 135-136). It is also to be considered that access to specific portions of the landscape can be hampered or restricted by cultural, economic, or social norms (e.g., Wright et al. 2015: 227-228).

In addition to the type of activity, the duration of the depositional processes leading to the formation of the deposit is a second aspect central to the interpretation of the wood charcoal record. In these regards, anthracological deposits can be classified into long- and short-term contexts (Chabal 1992, Asouti and Austin 2015, Thery-Parisot et al. 2010, Kabukcu and Chabal 2021). Short-term deposits are represented by concentrations of charcoal, which are found in direct association with the structures/loci where their combustion occurred (e.g., hearth, oven, fireplace, etc.). Short-term deposits represent, accordingly, single firing events. Their wood charcoal composition is expected to reflect the firewood that was available at the specific moment in time when the fire event occurred (e.g., Badal Garcia 1992). On the contrary, long-term deposits are composed by scattered charcoal fragments, found in middens, trash dumps, and other secondary contexts. In these latter deposits, the wood charcoal assemblage is expected to have originated from the residues of a plurality of firing events, which occurred elsewhere at the site. In these instances, the quantitative taxonomic composition of the wood charcoal present is expected to reflect a more general firewood exploitation pattern in place during the period covered by deposition (Chabal 1992, Chabal et al. 1999, Asouti and Austin 2005, Thery-Parisot et al. 2010, Kabukcu and Chabal 2021).

A further important contribution of the Montpellier School concerns sampling and subsampling strategies. As demonstrated by Chabal (1992), regardless of the taxon, anthracological assemblages are characterized by the presence of numerous small and few large charcoal fragments – a phenomenon defined as the 'Law of Fragmentation". The presence of this general pattern indicates that anthracological assemblages are only randomly impacted by the fragmentation processes occurring in pre-depositional, depositional, and post-depositional contexts – a consideration which is ultimately corroborated by the presence of a high correlation between weight- and count-based quantifications (Chabal 1992). The size of the subsample – i.e., the number of wood charcoal fragments to be analyzed in each sample – can be assessed using rarefaction curves, a common tool in quantitative ecology (Chiarucci et al. 2008). Based on these latter curves, a 100-fragment subsample is generally considered adequate in temperate environments (Keepax 1988), while higher counts are to be favored in regions having a greater floristic diversity (Chabal et al. 1999, Asouti and Austin 2005).

To sum up, in order to provide reliable quantitative reconstructions of past vegetation, wood charcoal analysis has to be preferentially conducted on secondary deposits, with scattered charcoal originating from domestic fire activities. While analysis conducted on other contexts, including primary deposits, could inform on other aspects on past uses and exploitations of wood resources (Thery-Parisot et al. 2010, Asouti and Austin 2005, Kabukcu and Chabal 2021).

In the last decade, anthracological research has moved past the sole taxonomic identification of the analyzed specimens. A growing body of literature has incorporated dendrometric approaches into wood charcoal analysis (e.g., Dufraisse and Garcia Martinez 2011, Dufraisse et al. 2018, Wright 2018, Kabukcu 2018b, Picornell et al. 2020, Alcolea et al. 2021, Marston et al. 2021). Stable isotopes analysis has been, furthermore, successfully applied to wood charcoal specimens (e.g., Hall et al. 2008, Masi et al. 2013a, 2013b, Fiorentino et al. 2015, Baton et al. 2017, Vignola et al. 2018, Audiard et al. 2019, 2021a, 2021b). These new approaches to anthracological research are expected to gain further centrality in forthcoming scholarship (e.g., Dufraisse et al. 2022).

2.1.2 *A brief history of archaeobotanical research in Anatolia*

Before moving to the survey of the published carpological literature from Anatolia (Section 2.1.3), in this section I will provide a concise overview of the historical development or archaeobotanical research in modern Turkey, a topic which is to date not yet properly covered in the literature. Rather than to fill this gap in the scholarship, the aim of this section is to highlight some general trends in Anatolian archaeobotanical research. In addition to discussing such trends, in the following paragraphs, I will emphasize the role that some key scholars played in the establishment and development of archaeobotanical research in Asia Minor. It is, in fact, this long tradition of study which ultimately provides the foundations on which much of this dissertation is based.

Mirroring a general pattern in environmental archaeology (Rapp and Hill 2006: 4), and borrowing the specific terminology from Birks and Berglund (2018), the development of archaeobotanical research in Anatolia can be divided into three main stages: (*i*) a *pioneer phase* occurring in the second half of the 19th century and first half of the 20th century, which corresponds to the earliest developments of archaeobotany, in Turkey as well as elsewhere; (*ii*) a *building phase*, occurring roughly between 1950s and 1980s. In these years the first quantitative studies are conducted, providing the basis for future research; and (iii) starting in the 1990s a *mature phase*, which is characterized by an exponential growth in archaeobotanical research. This general trend is well summarized in Figure 2.1.

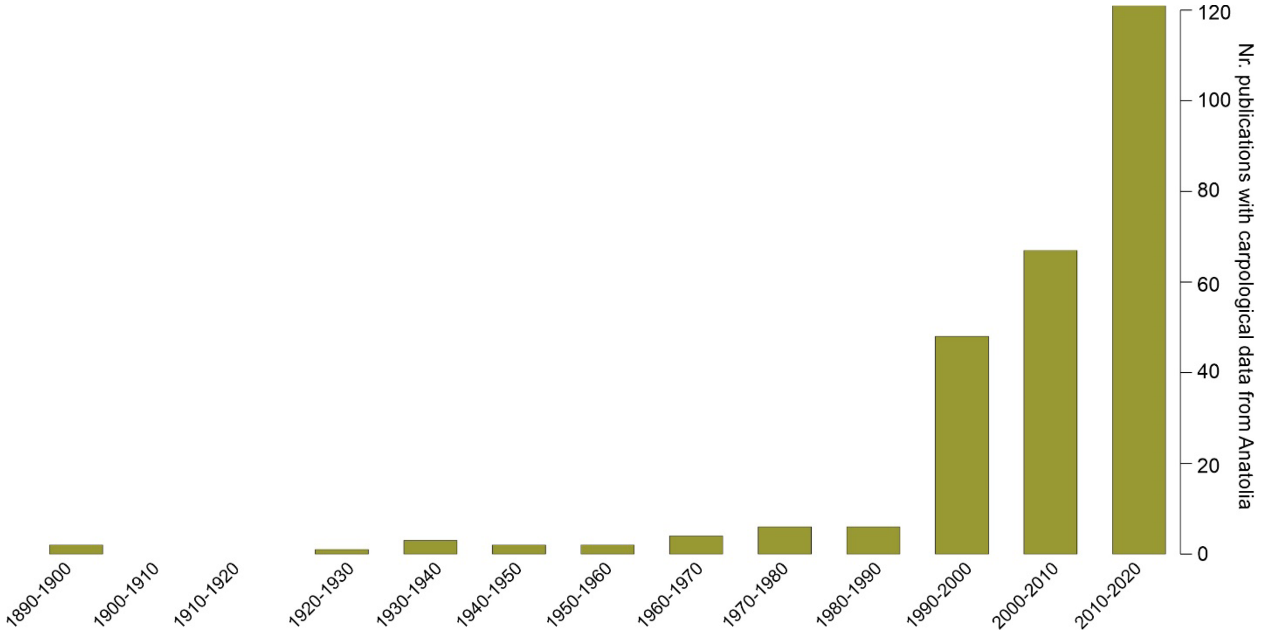


Figure 2.1 – *Archaeobotanical research in Anatolia: the graph shows the number of publications containing carpological data (listed in Appendix 1) grouped by decades.*

As noted in Section 2.1.1, the earliest archaeobotanical research in the mid-19th century stemmed from two distinct research traditions: the study of waterlogged plant remains in Central Europe and of desiccated materials in Egypt and South America (Renfrew 1973: 1-6, Pearsall 2015: 28-30). The German botanist Carl Ludwig Wittmack (1839-1929) was one of the few scholars involved in research on both fronts of early archaeobotany (Renfrew 1973: 1-6). Prompted by the early wave of German archaeological research in Asia Minor (e.g., Easton 2002), Wittmack's interests soon expanded also to the Anatolian Peninsula.

Rudolf Virchow, the well-known German politician and scholar, during a visit in 1879 to Schliemann's excavations at Troy, collected a rich charred carpological assemblage, which allegedly originated from Troy II storerooms (Virchow 1879). Virchow brought these remains to Berlin, where they were analyzed by Wittmack. The publication resulting from these analyses (Wittmack 1880) represents, in my knowledge, the first published archaeobotanical study conducted on materials from Anatolia. The site of Troy provided materials for other, early, archaeobotanical studies – including research conducted by the German botanist Gustav Lindau on materials from Wilhelm Dörpfeld excavations (1893/1894) (Lindau 1922).

In addition to Schliemann and Virchow, Wittmack's involvement in Anatolian archaeobotany intersected with a further key figure in the history of western Asian archaeology: Gustav Körte. Together with his brother Alfred, Gustav Körte is most notably associated to the first excavations conducted at the site of Gordion, in 1890 (Körte and Körte 1904). In addition to Gordion, the Körte brothers conducted other fieldwork in central Anatolia, including in 1895 a small-scale excavation at the site of Bozhöyük, a Bronze Age mound located in the Lake District of southwestern-central Anatolia. Charred seeds collected from Bozhöyük were analyzed by Wittmack and published by the author in 1896.

Alacahöyük (Dix 1938, 1944) and Alişar Höyük (Harlan et al. 1937, Record 1937) are two other sites of interest within early archaeobotanical research. During the direction of von der Osten (Oriental Institute, University of Chicago), seed/fruit remains collected from Alişar Höyük were analyzed by a team lead by the US botanist and agronomist, Jack R. Harlan (1937), a key figure in early plant domestication studies. While single wood and wood charcoal fragments from the same site were identified by Samuel J. Record (1937). At Alacahöyük, archaeobotanical samples from the Turkish excavation project – which was jointly led by Remzi Oğuz Arık and Hamit Koşay, and directly sponsored by Kamal Atatürk (Çınaroğlu and Çelik 2010) – were analyzed by the German botanist Walter Dix (1938, 1944). Dix fled to Ankara (Yüksek Ziraat Enstitüsüdür YZE) from Germany during the National Socialist regime, as part of a broader diaspora to Turkey of German-Jewish scholars (see Reisman 2007), who's role to the formation of Turkish modern academia can be hardly overstated.

The common denominator among these first, pioneering, archaeobotanical studies is the analysis of single archaeological specimens, lacking quantitative attempts, and producing highly problematic identifications. All aspects that reflect the general infancy of archaeobotanical research. The situation drastically changed in the second half of the century, benefitting from the deployment of new methodological approaches, which ultimately promoted the expansion of archaeobotanical research to an increasing number of sites (e.g., Nesbitt and Samuel 1996a). The research conducted in the decades from 1950 to 1980 represents a foundational phase of Anatolian and western Asian archaeobotany. Without undermining the contribution of other colleagues, in Turkey these developments are closely associated with three scholars: Hans Helbæk (1907-1981), Willem van Zeist (1924-2016), and Gordon Hillman (1943-2018).

Hans Helbæk is, rightfully, regarded as a central figure in the establishment of modern archaeobotany (Renfrew 1973: 2). The Danish archaeobotanist conducted extensive research at prehistoric and historic sites in Denmark, Ireland, and England. At a later stage in his career, Helbæk expanded his research agenda to western Asia, driven by an interest on the topic of domestication studies. In his research in western Asia, Helbæk collaborated with key figures in the establishment of Near Eastern prehistoric archaeology, such as Robert J. Braidwood in Iraq, Frank Hole and Kent Flannery in Iran, Diane Kirkbride in Palestine, and James Mellaart in Anatolia (Renfrew 1973: 2, and references therein).

The involvement of Helbæk in Anatolian archaeobotany is, thus, connected with excavations conducted by James Mellaart (Hodder 2015), who was, at the time, Assistant Director at the British Institute in Ankara. Those projects took place at the Neolithic and early Chalcolithic site of Hacılar (Helbæk 1970), Bronze Age Beycesultan (Helbæk 1961), and the Neolithic occupation of Çatalhöyük (Helbæk 1964).

Willem van Zeist (1924-2016) is a second, later, key scholar promoting the establishment of archaeobotanical research in Anatolia. Van Zeist is one of the most prolific scholars in archaeobotany and paleobotany (Cappers and Kooi 2016). The research of Van Zeist encompassed both carpological and palynological analysis, in Europe and western Asia. Van Zeist, assisted by his early students Styze Bottema and Henk Woldring, conducted the first systematic pollen studies in western Asia (including Anatolia) (see Section 2.2), which provided the backbone for our understanding of regional vegetation history during the Late Pleistocene and Holocene (e.g., Bottema and van Zeist 1991). The author conducted and published carpological research at the Neolithic sites of Aşıklı Höyük (van Zeist and de Roller 1995, 2003a), Çayönü Tepesi (van Zeist 1972, van Zeist and de Roller 1992, van Zeist and de Roller 2003b) and Erbaba (van Zeist and Buitenhuis 1983); at the Chalcolithic sites of Girikihaciyan (van Zeist 1979), Fatmall Kalecik (van Zeist 1998), Ilipinar (van Zeist et al. 1995), and İkiztepe (van Zeist 2003); as well as at the multi-period sites of Korucutepe and Tepecik-Elazığ (van Zeist and Bakker-Heeres 1974, 1975).

Gordon Hillman is a further central author meriting acknowledgment in this brief overview. The contributions of Hillman to this pivotal phase in Anatolian and, more in general, western Asia archaeobotany can hardly be overstated (Fairbairn and Weiss 2009, Fairbairn and Nesbitt 2019). Hillman participated to the excavation projects conducted by the British Institute in Ankara (BIAA) at the sites of Can Hassan III (1969) and Aşvan (1970-1973), in both instances under the direction of David French. During these field projects, Hillman developed the first large-scale flotation systems to be used in Anatolia, which allowed for the processing of large amounts of sediment sampled during excavations.

David French's excavation project at Aşvan-Elazığ represents a more general milestone in the history of western Asia archaeology, anticipating future research that emphasized paleoenvironmental analyses, the long-duree of economic processes, and the use of ethnographic observations. Within the framework of the Aşvan project, Hillman conducted a study of the traditional farming system present in the Elazığ district (Hillman 1973), which ultimately allowed the author to develop the cereal processing model (Hillman 1981, 1984a) that remains still to date extremely influential in archaeobotanical theory.

Gordon Hillman, furthermore, trained a generation of archaeobotanists active in Anatolia and western Asia. Among his former students, I shall mention George Willcox, who conducted the first systematic quantitative wood charcoal studies in Anatolia, at Can Hassan III and Aşvan-Elazığ (Willcox 1974).

Starting in the 1990s (see Nesbitt and Samuels 1996, Marston and Castellano 2021), a period of exponential growth in Anatolian archaeobotanical research followed (Figure 2.1). The list of the authors active in the last few decades is too long to enumerate here (see Appendix 1 and Appendix 2). Despite this intensification of archaeobotanical research, several gaps are still present in the chronological and geographic coverage of the Anatolian Peninsula – as will emerge in the literature survey provided in the next section.

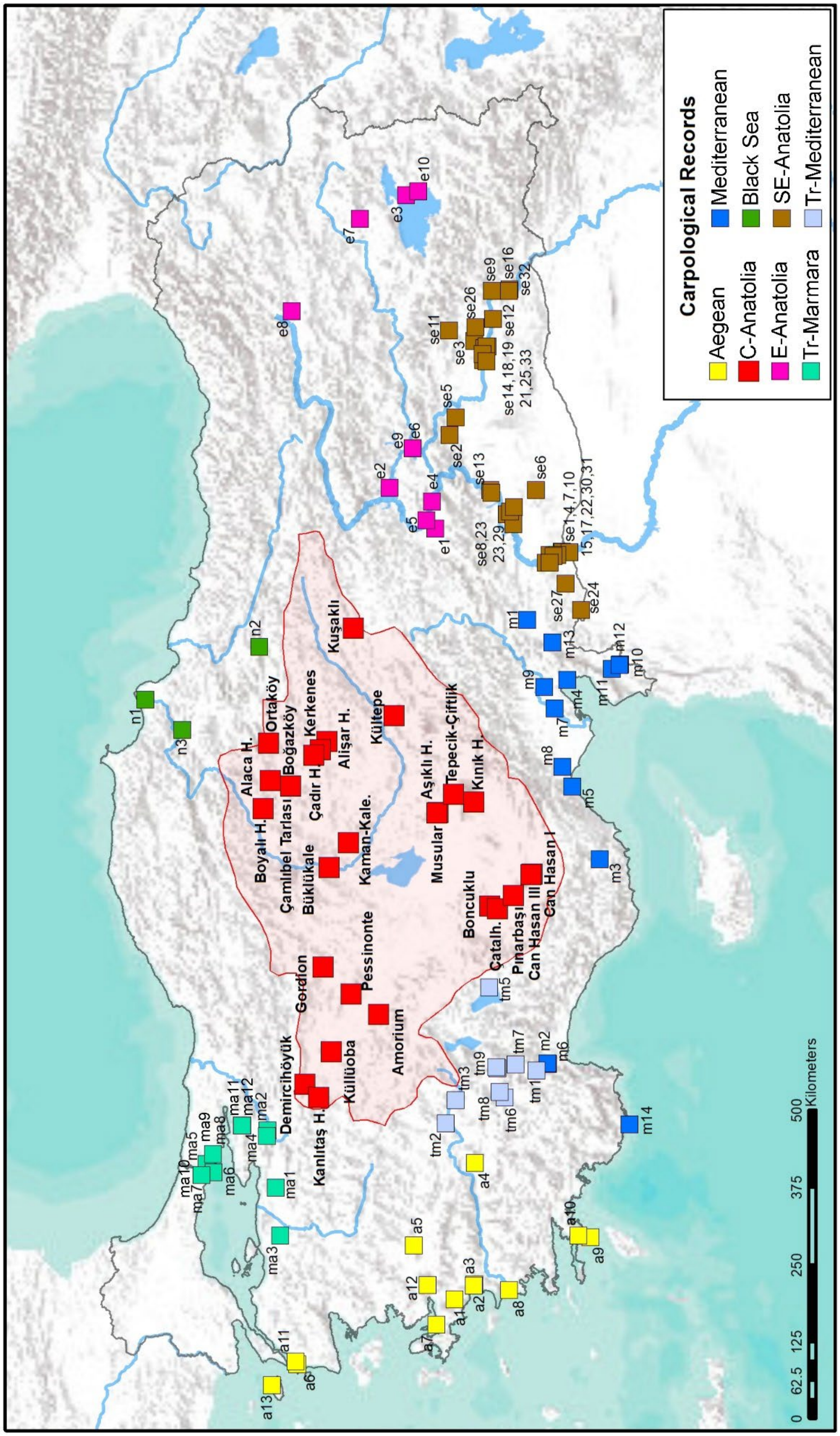
2.1.3 *A Survey of the Anatolian archaeobotanical literature: carpological records*

This review encompasses all archaeobotanical studies for contemporary Turkey, dating from the Epipaleolithic to the Medieval period (Table 2.1, Figure 2.2). In Appendix 1, I provide a complete list of Anatolian sites with published carpological evidence, including site coordinates, climatological data, period covered by the archaeobotanical study, and bibliographic references. An earlier version of this survey has been published in Marston and Castellano 2021.

For the purposes of this review, the Anatolian Peninsula is divided into 8 ecological macro-regions: Black Sea, Central Anatolia, Eastern Anatolia, Southeastern Anatolia, Transitional Mediterranean, Mediterranean, Aegean, and Marmara Transitional (Section 1.1).

	Central	Southeasten	Eastern	Mediterranean	Aegean	Tr. Med.	Marmara	Northern
Epipaleolithic *(pre 9,700 BCE)*	—	Körtik Tepe	Hallan Çemi	Karain B; Okuzini	—	—	—	—
Aceramic Neolithic *(c. 9,700 – 7,000 BCE)*	Aşıklı Höyük; Boncuklu; Çatalhöyük; Pınarbaşı; (*Can Hassan III*)	Çayönü Tepesi; Göbekli Tepe; Gritille; Gusir Höyük; Cafer Höyü; Nevalı Çori; Körtik Tepe; (*Akarçay Tepe*); (*Demirköy*); (*Hasankeyf Höyük*)	—	—	—	—	—	—
Ceramic Neolithic *(c. 7,000 – 6,000 BCE)*	Çatalhöyük; (*Musular*); (*Tepecik-Çiftlik*)	Çayönü Tepesi; Sumaki Höyük	—	Mersin-Yümüktepe	Ulucak	Erbaba; Höyücek; (*Bademağacı Höyük*); (*Hacılar*)	(*Aktopraklık*); (*Barcın Höyük*); (*Yenikapi*); (*Pendik Höyük*)	—
Early Chalcolithic *(c. 6,000 – 5,400 BCE)*	Çatalhöyük; (*Kanlıtaş Höyük*); (*Tepecik-Çiftlik*)	(*Fıstıklı Höyük*)	—	Dumuztepe	—	(*Bademağacı Höyük*); (*Hacılar*)	İlipınar; (*Aktopraklık*)	—
Middle Chalcolithic *(c. 5,400 – 4,500 BCE)*	Can Hasan I; (*Kanlıtaş Höyük*)	Kenan Tepe; Tell Kurdu; Girikihacıyan	Aşvan-Fatmali Kalecik	—	Kumtepe	—		—
Late Chalcolithic *(c. 4,500 – 3,000 BCE)*	Çadır Höyük; Çamlıbel Tarlası; (*Kanlıtaş Höyük*)	Hacinebi; Yarım Höyük; (*Hassek Höyük*); (*Kurban Höyük*); (*Kuriki Höyük*)	Arslantepe; Aşvan-Çayboyu; Aşvan-Fatmali Kalecik; Sos Höyük; (*Korucutepe*); (*Sos Höyük*)	—	Kumtepe; Bakla Tepe; Çukuriçi Höyük; Liman Tepe	Kuruçay Höyük	—	Ikiztepe
Early Bronze Age *(c. 3,000 – 2,000 BCE)*	Demircihüyük; Küllüoba; Kültepe-Kanesh; Çadır Höyük	Titriş Höyük; Mezraa Höyük; Gre Virike; Tilbaşar Höyük; Titriş Hoyuk; Ziyaret Tepe; (*Hassek Höyük*); (*Horum Höyük*); (*Kurban Höyük*)	Arslantepe; Aşvan-Aşvan Kale; Aşvan-Taşkun Mevkii; İmanoğlu Höyük; Sos Höyük; Korucutepe; (*Tepecik- Elazığ*)	Mersin-Yümüktepe; Tell Tayinat	Troy; Bakla Tepe; Çukuriçi Höyük; Liman Tepe; Yenibademli Höyük	(*Bademağacı Höyük*); (*Boz Höyük*)	—	Ikiztepe; Oymaağaç
Middle Bronze Age *(c. 2,000 – 1,600 BCE)*	Boğazköy; Boyalı Höyük; Büklükale; Gordion; Kaman-Kalehoyuk; Kültepe-Kanesh; (*Çadır Höyük*)	Hirbemerdon Tepe; Mezraa Höyük; Salat Tepe; Ziyaret Tepe; (*Horum Höyük*)	Sos Höyük; Korucutepe; (*Tepecik- Elazığ*)	Kilise Tepe; Tatarlı Höyük	Troy		—	Ikiztepe
Late Bronze Age *(c. 1,600 – 1,200 BCE)*	Boğazköy; Gordion; Kuşaklı; Ortaköy; Kınık Höyük; (*Alaca Höyük*); (*Çadır Höyük*)	Karkemish; Tille Höyük; Ziyaret Tepe	Aşvan-Aşvan Kale; (*Korucutepe*); (*Tepecik- Elazığ*)	Kilise Tepe; Kinet Hoyuk; Tatarlı Höyük; Tell Atchana; Ulu Burun; (*Tarsus-Gözlükule*)	Kaymakci; Troy	Beycesultan	—	Oymaağaç
Iron Age *(c. 1,200 – 300/200 BCE)*	Gordion; Kuşaklı; Kerkenes; Kınık Höyük; (*Alişar Hüyük*); (*Boğazköy*); (*Çadır Höyük*); (*Kaman-Kalehoyuk*)	Ziyaret Tepe; Zeviya Tivilki; Karkemish; Ziyaret Tepe; Tille Höyük	Ayanis; Sos Höyük; Patnos; Yoncatepe	Kilise Tepe; Sirkeli; Tell Tayinat; Kinet Hoyuk; (*Tatarli Höyük*)	Miletus; Troy	(*Düzen Tepe*)	Daskeleion; Ayazmaçukur	Oymaağaç
Hellenistic *(c. 300/200 – 1 BCE)*	Gordion; Pessinonte; Kınık Höyük	Karkemish; Tille Höyük	Aşvan-Aşvan Kale	Tatarlı Höyük	Ephesos	(*Düzen Tepe*); (*Sagalassos*)	Daskeleion; Ayazmaçukur	Oymaağaç*
Roman *(c. 1 – 400 CE)*	Gordion; Pessinonte; Kınık Höyük; (*Amorium*)	Ilısu Höyük; Zeugma	Aşvan-Aşvan Kale	—	Ephesos	(*Sagalassos*)	—	Oymaağaç*
Early and Middle Byz. *(c. 400 – 1100/200 CE)*	Gordion; Pessinonte; Amorium; (*Çadır Höyük*)	Gritille; Ziyaret Tepe; Karkemish; Mezraa Höyük; Gre Virike	Aşvan-Aşvan Kale	Kinet Hoyuk; Mersin-Yümüktepe; Kilise Tepe; (*Tarsus-Gözlükule*)	Hierapolis; Serçe Limanı; Bozburun	Sagalassos; Beycesultan	Beşiktaş; Küçükyalı	Oymaağaç; Komana
Late Byz./Selj./Ott. *(after 1100/1200 CE)*	Gordion; Kınık Höyük; Kaman-Kalehöyük; Amorium; (*Can Hassan III*)	Mezraa Höyük; Gre Virike	Aşvan-Aşvan Kale; Aşvan-Taşkun Kale; Korucutepe	Kilise Tepe; Kinet Hoyuk-Tüpraş Field	—	—	Daskeleion; Aydos Castle; Dikilitaş	Komana

Table 2.1 –*Carpological sequences from Anatolia. For further information see Appendix 1. The evidence from the sites reported in parenthesis has not yet been quantitatively published.* (**=assemblage dated generically to the Hellenistic/Roman period*).


Carpological Records
🟨 Aegean
🟥 C-Anatolia
🟪 E-Anatolia
🟩 Tr-Marmara
🟦 Mediterranean
🟩 Black Sea
🟫 SE-Anatolia
🟦 Tr-Mediterranean
0 62.5 125 250 375 500 Kilometers
Alaca H.
Ortaköy
Boğazköy
Kerkenes
Alişar H.
Çadır H.
Kültepe
Kuşaklı
Boyalı H.
Çamlıbel Tarlası
Büklükale
Kaman-Kale.
Aşıklı H.
Tepecik-Çiftlik
Kınık H.
Musular
Boncuklu
Çatalh.
Pınarbaşı
Can Hasan III
Can Hasan I
Gordion
Pessinonte
Amorium
Demircihöyük
Küllüoba
Kanlıtaş H.
n1
n2
n3
e1
e2
e3
e4
e5
e6
e7
e8
e9
e10
se1,4,7,10
15,17,22,30,31
se2
se3
se5
se6
se8,23
23,29
se9
se11
se12
se13
se14,18,19
21,25,33
se16
se24
se26
se27
se32
m1
m2
m3
m4
m5
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m11
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m14
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a13

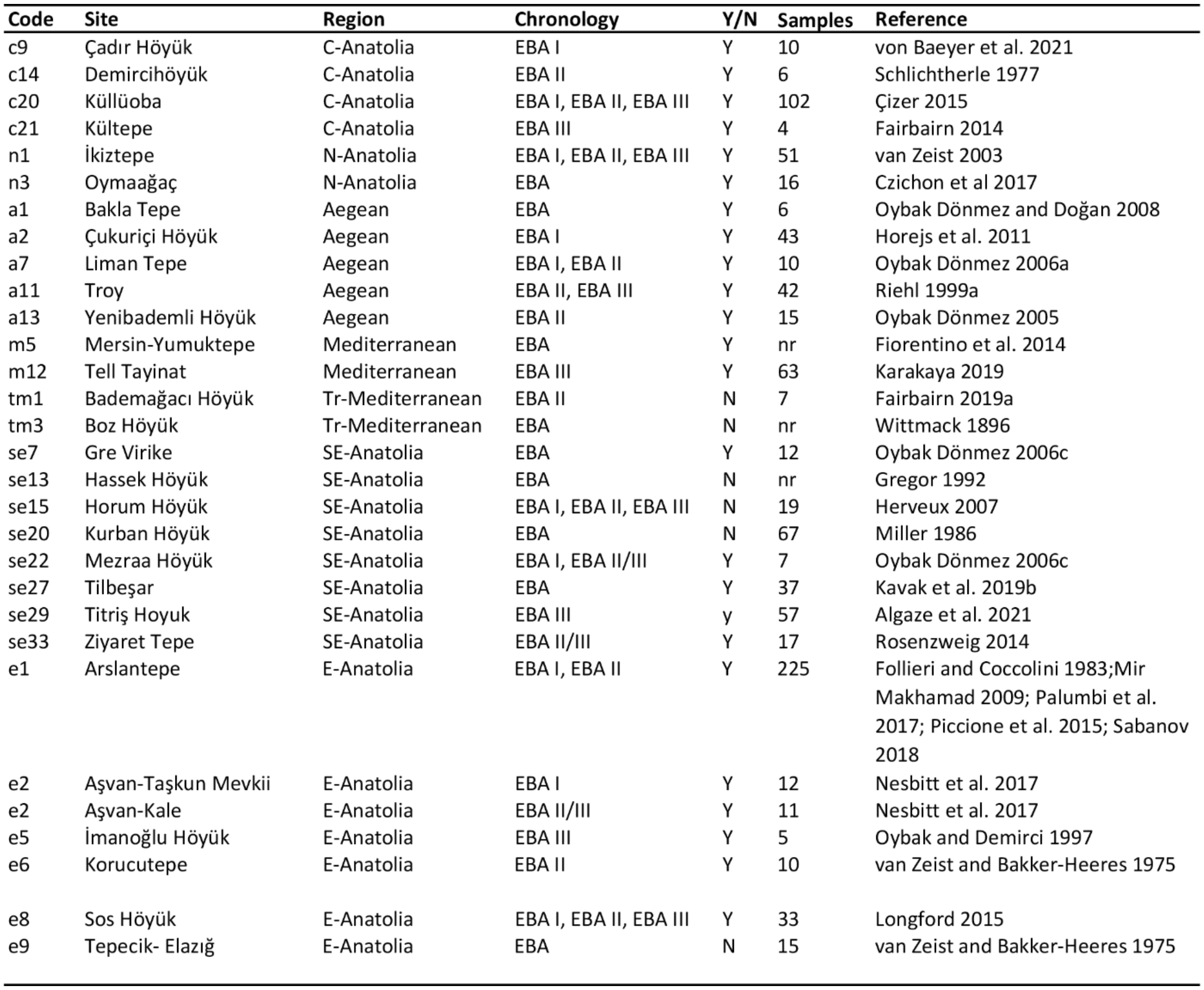
(Previous page) Figure 2.2 – *Sites with published carpological remains, by region* (*see* Chapter 1). *Site codes correspond to* Appendix 1*. Ecological regions are delineated after* Atalay 2014*. Central Anatolia is red.*

Leaving to Table 2.1 and Appendix 1 a full list of the available (published) archaeobotanical evidence, in the following paragraphs, I will provide a detailed literature survey of the carpological assemblages dated from the Early Bronze Age to the Hellenistic period. For background information on the specific sites and for the broader historical and archaeological context, I direct your attention to Section 1.2. The archaeobotanical evidence published in these studies will be presented and discussed in Chapter 7.

- *Early Bronze Age* (*ca. 3000-2000 BCE*)

Table 2.2 summarizes the carpological record dated to the Early Bronze Age (EBA; ca. 3000-2000 BCE; Section 1.2.1). The location of the sites is provided in Figure 2.3. A total of four archaeobotanical sequences are currently available from EBA central Anatolia: Çadır Höyük, Küllüoba, Demircihüyük, and Kültepe.

The site of Küllüoba, in northwestern Anatolia (Eskisehir), is the reference Bronze Age archaeobotanical sequence from central Anatolia, with 102 analyzed samples spanning the entire third millennium BCE (Çizer 2015). Six samples have been analyzed from the EBA II occupation of the nearby site of Demircihüyük (Schlichtherle 1977). Von Baeyer et al. (2021) published a recent archaeobotanical study conducted on Late Chalcolithic levels from Çadır Höyük, a multi-period mounded site located in northcentral Anatolia, in the Yozgat province. Ten samples, originating from the "Transitional Building" (Trench SES1) phase are attributed to the transition from the Late Chalcolithic to the Early Bronze Age (ca. 3100-2900 BCE) (Von Baeyer et al. 2021), and accordingly included in this review. Finally, four samples have been analyzed from the EBA III levels of the citadel of Kültepe, near Kayseri (Fairbairn 2014).



Code	Site	Region	Chronology	Y/N	Samples	Reference
c9	Çadır Höyük	C-Anatolia	EBA I	Y	10	von Baeyer et al. 2021
c14	Demircihöyük	C-Anatolia	EBA II	Y	6	Schlichtherle 1977
c20	Küllüoba	C-Anatolia	EBA I, EBA II, EBA III	Y	102	Çizer 2015
c21	Kültepe	C-Anatolia	EBA III	Y	4	Fairbairn 2014
n1	İkiztepe	N-Anatolia	EBA I, EBA II, EBA III	Y	51	van Zeist 2003
n3	Oymaağaç	N-Anatolia	EBA	Y	16	Czichon et al 2017
a1	Bakla Tepe	Aegean	EBA	Y	6	Oybak Dönmez and Doğan 2008
a2	Çukuriçi Höyük	Aegean	EBA I	Y	43	Horejs et al. 2011
a7	Liman Tepe	Aegean	EBA I, EBA II	Y	10	Oybak Dönmez 2006a
a11	Troy	Aegean	EBA II, EBA III	Y	42	Riehl 1999a
a13	Yenibademli Höyük	Aegean	EBA II	Y	15	Oybak Dönmez 2005
m5	Mersin-Yumuktepe	Mediterranean	EBA	Y	nr	Fiorentino et al. 2014
m12	Tell Tayinat	Mediterranean	EBA III	Y	63	Karakaya 2019
tm1	Bademağacı Höyük	Tr-Mediterranean	EBA II	N	7	Fairbairn 2019a
tm3	Boz Höyük	Tr-Mediterranean	EBA	N	nr	Wittmack 1896
se7	Gre Virike	SE-Anatolia	EBA	Y	12	Oybak Dönmez 2006c
se13	Hassek Höyük	SE-Anatolia	EBA	N	nr	Gregor 1992
se15	Horum Höyük	SE-Anatolia	EBA I, EBA II, EBA III	N	19	Herveux 2007
se20	Kurban Höyük	SE-Anatolia	EBA	N	67	Miller 1986
se22	Mezraa Höyük	SE-Anatolia	EBA I, EBA II/III	Y	7	Oybak Dönmez 2006c
se27	Tilbeşar	SE-Anatolia	EBA	Y	37	Kavak et al. 2019b
se29	Titriş Hoyuk	SE-Anatolia	EBA III	y	57	Algaze et al. 2021
se33	Ziyaret Tepe	SE-Anatolia	EBA II/III	Y	17	Rosenzweig 2014
e1	Arslantepe	E-Anatolia	EBA I, EBA II	Y	225	Follieri and Coccolini 1983;Mir Makhamad 2009; Palumbi et al. 2017; Piccione et al. 2015; Sabanov 2018
e2	Aşvan-Taşkun Mevkii	E-Anatolia	EBA I	Y	12	Nesbitt et al. 2017
e2	Aşvan-Kale	E-Anatolia	EBA II/III	Y	11	Nesbitt et al. 2017
e5	İmanoğlu Höyük	E-Anatolia	EBA III	Y	5	Oybak and Demirci 1997
e6	Korucutepe	E-Anatolia	EBA II	Y	10	van Zeist and Bakker-Heeres 1975
e8	Sos Höyük	E-Anatolia	EBA I, EBA II, EBA III	Y	33	Longford 2015
e9	Tepecik- Elazığ	E-Anatolia	EBA	N	15	van Zeist and Bakker-Heeres 1975

Table 2.2– *List of Anatolian Early Bronze Age sites with published carpological evidence. Both records published with quantitative (Y/N=Y), or non-quantitative (Y/N=N) data are included. Further information on each site/record are available in Appendix 1.*

Moving outside central Anatolia, the Turkish sector of the Euphrates Valley is comparatively well-covered by carpological research at EBA sites: Titriş Höyük (57 samples; Algaze et al. 2021), Tilbaşar Höyük (37 samples; Kavak et al. 2019b), Mezraa Höyük (7 samples; Oybak Dönmez 2006c), and Gre

Virike (12 samples; Oybak Dönmez 2006c) in the Upper-Middle Euphrates Valley; Arslantepe (225 samples; Follieri and Coccolini 1983, Mir Makhamad 2009, Pulumbi et al. 2017, Piccione et al. 2015, Sabanov 2018), Aşvan-Aşvan Kale (11 sample; Nesbitt et al. 2017), Aşvan-Taşkun Mevkii (12 samples; Nesbitt et al. 2017), and İmanoğlu Höyük (5 samples; Oybak Dönmez and Demirci 1997) in the Upper Euphrates Valley (Figure 2.3). Further upstream, in proximity to the upper reaches of the river, archaeobotanical results have been published from Sos Höyük, Period IVa (33 samples; Longford 2015). In comparison to the Euphrates, the Turkish sector of the Tigris is currently poorly sampled by carpological research for the 3rd millennium, with only a single quantitative carpological record to date published – Ziyaret Tepe (17 samples; Rosenzweig 2014).

Two EBA archaeobotanical sequences have been published from the Mediterranean region of Turkey: Tell Tayinat (63 samples; Karakaya 2019) and Mersin-Yümüktepe (number of samples not reported; Fiorentino et al. 2014). On the Aegean coast, EBA carpological evidence is published at Bakla Tepe (6 samples; Oybak Dönmez and Doğan 2008), Çukuriçi Höyük (43 samples; Horejs et al. 2011), and Liman Tepe (10 samples; Oybak Dönmez 2005) – all sites located in the Izmir district. Further to the north, in the Çanakkale district, EBA archaeobotanical evidence is available from Troy (42 samples; Riehl 1999a) and Yenibademli Höyük (15 samples; Oybak Dönmez 2005).

Finally, two sequences are available from the Pontus region: Ikiztepe (10 samples with count data; van Zeist 2003), and Oymaağaç Höyük (16 samples; Czichon et al. 2017). Northern Anatolia is a region poorly sampled for archaeobotanical research throughout the entire period here considered, reflecting a more generalized paucity of archeological evidence (e.g., Matthews and Glatz 2009).

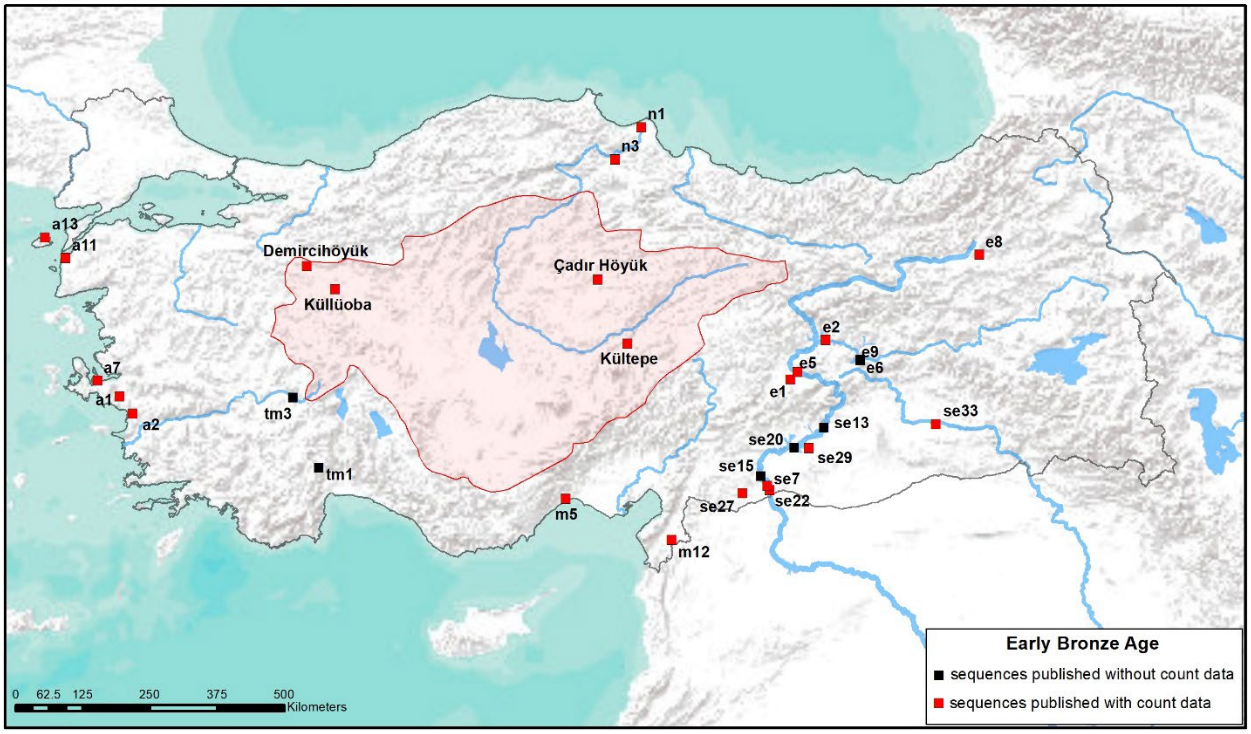

n1
n3
a13
a11
Demircihöyük
Küllüoba
Çadır Höyük
e8
e2
e9
e6
e5
e1
Kültepe
a7
a1
a2
tm3
se13
se33
se20
se29
se15
se7
tm1
m5
se27
se22
m12
Early Bronze Age
■ sequences published without count data
🟥 sequences published with count data
0 62.5 125 250 375 500
Kilometers

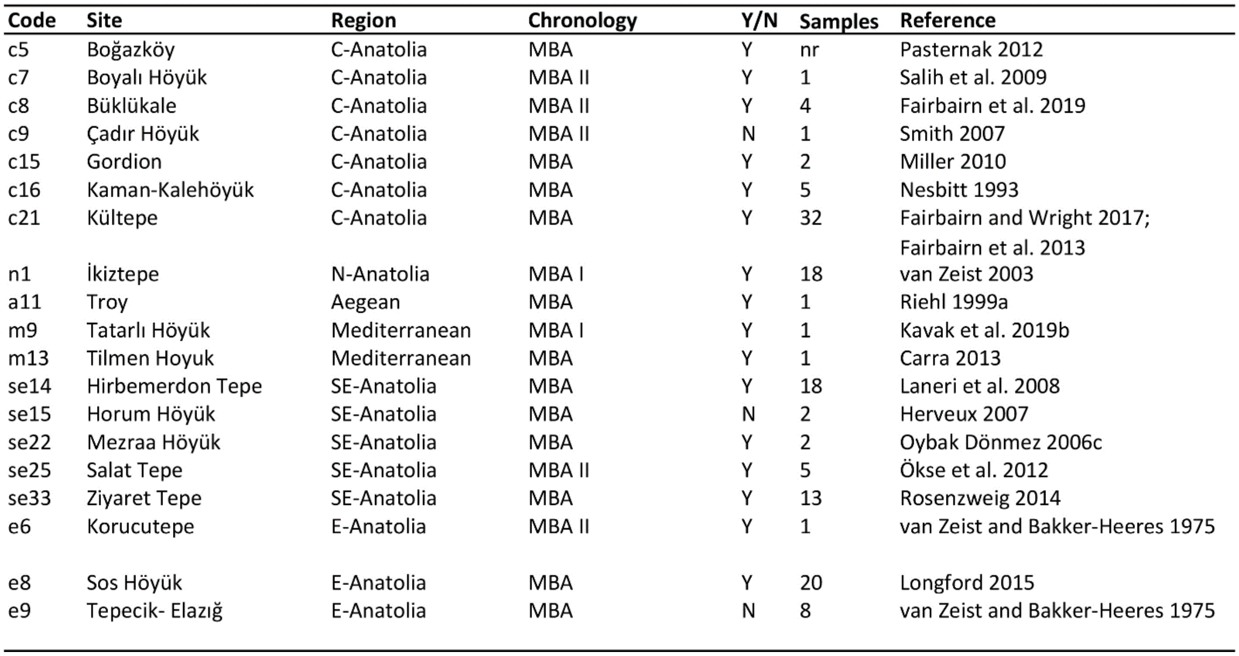
Figure 2.3 – *Sites with published archaeobotanical seed/fruit remains dating to the Early Bronze Age. Site codes correspond to Table 2.2 and Appendix 1. Central Anatolia is marked in red.*

- *Middle Bronze Age* (*ca. 2000-1600 BCE*)

A total of six carpological sequences published with quantitative data are currently available from Middle Bronze Age (MBA; ca. 2000-1600 BCE; Section 1.2.2) central Anatolia: Boğazköy; Boyalı Höyük; Büklükale; Gordion; Kaman-Kalehoyuk; and Kültepe-Kanesh (Table 2.3, Figure 2.4). As I will discuss in the next paragraph, most of these studies are based on a few (or single) samples, making the MBA a period poorly covered by archaeobotanical research in central Anatolia.

Carpological samples have been analyzed from both the Assyrian trade colony (*karum*) and the citadel of the site of Kültepe-*Kanesh* (32 samples; Fairbairn et al. 2013, Fairbairn and Wright 2017), located near Kayseri. An unreported number of samples have been processed also from MBA levels at Boğazköy-*Ḫattuša* (Pasternak 2012). To the north of Boğazköy, at Boyalı Höyük, Salih et al. (2019)

published a single sample from a vessel fill. In the middle course of the Kızılırmak River, archaeobotanical evidence is available from Büklükale (4 samples; Fairbairn et al. 2019), a study based on material originating from a possible ritual context. In the same region, evidence is also published for the MBA occupation of Kaman-Kalehoyuk (5 samples; Nesbitt 1993)[4]. Because of limited exposure, only a very modest number of samples is available from Yassıhüyük-*Gordion* (2 samples; Miller 2010).



Code	Site	Region	Chronology	Y/N	Samples	Reference
c5	Boğazköy	C-Anatolia	MBA	Y	nr	Pasternak 2012
c7	Boyalı Höyük	C-Anatolia	MBA II	Y	1	Salih et al. 2009
c8	Büklükale	C-Anatolia	MBA II	Y	4	Fairbairn et al. 2019
c9	Çadır Höyük	C-Anatolia	MBA II	N	1	Smith 2007
c15	Gordion	C-Anatolia	MBA	Y	2	Miller 2010
c16	Kaman-Kalehöyük	C-Anatolia	MBA	Y	5	Nesbitt 1993
c21	Kültepe	C-Anatolia	MBA	Y	32	Fairbairn and Wright 2017; Fairbairn et al. 2013
n1	İkiztepe	N-Anatolia	MBA I	Y	18	van Zeist 2003
a11	Troy	Aegean	MBA	Y	1	Riehl 1999a
m9	Tatarlı Höyük	Mediterranean	MBA I	Y	1	Kavak et al. 2019b
m13	Tilmen Hoyuk	Mediterranean	MBA	Y	1	Carra 2013
se14	Hirbemerdon Tepe	SE-Anatolia	MBA	Y	18	Laneri et al. 2008
se15	Horum Höyük	SE-Anatolia	MBA	N	2	Herveux 2007
se22	Mezraa Höyük	SE-Anatolia	MBA	Y	2	Oybak Dönmez 2006c
se25	Salat Tepe	SE-Anatolia	MBA II	Y	5	Ökse et al. 2012
se33	Ziyaret Tepe	SE-Anatolia	MBA	Y	13	Rosenzweig 2014
e6	Korucutepe	E-Anatolia	MBA II	Y	1	van Zeist and Bakker-Heeres 1975
e8	Sos Höyük	E-Anatolia	MBA	Y	20	Longford 2015
e9	Tepecik- Elazığ	E-Anatolia	MBA	N	8	van Zeist and Bakker-Heeres 1975

Table 2.3– *List of Anatolian Middle Bronze Age sites with published carpological evidence. Both records published with quantitative (Y/N=Y), or non-quantitative (Y/N=N) data are included. Further information on each site/record are available in Appendix 1.*

The Middle Bronze Age is poorly covered by carpological research also elsewhere in the Anatolian Peninsula, both in terms of number of sites with published evidence and number of samples analyzed (Table 2.3). Three sequences are available from the middle Tigris Valley: Hirbemerdon Tepe

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[4] In Fairbairn 2002, 2003, 2004, 2006; Fairbairn et al. 2007b; Fairbairn and Bradley 2008 preliminary results from additional samples are published using a subjective semi-quantitative scale. Extensive analysis are included in an unpublished PhD dissertation (Üstünkaya 2015).

(18 samples; Laneri et al 2008), Salat Tepe (5 samples, Ökse et al 2012), and Ziyaret Tepe (13 samples; Rosenzweig 2014). Only a single MBA sequence is published from the Upper-Middle Euphrates Valley: Mezraa Höyük (2 samples, Oybak Dönmez 2006c). In eastern Anatolia, 20 samples from Sos Höyük (Longford 2015) are attributed to Period IVb, which corresponds in absolute chronological terms to the Middle Bronze Age.

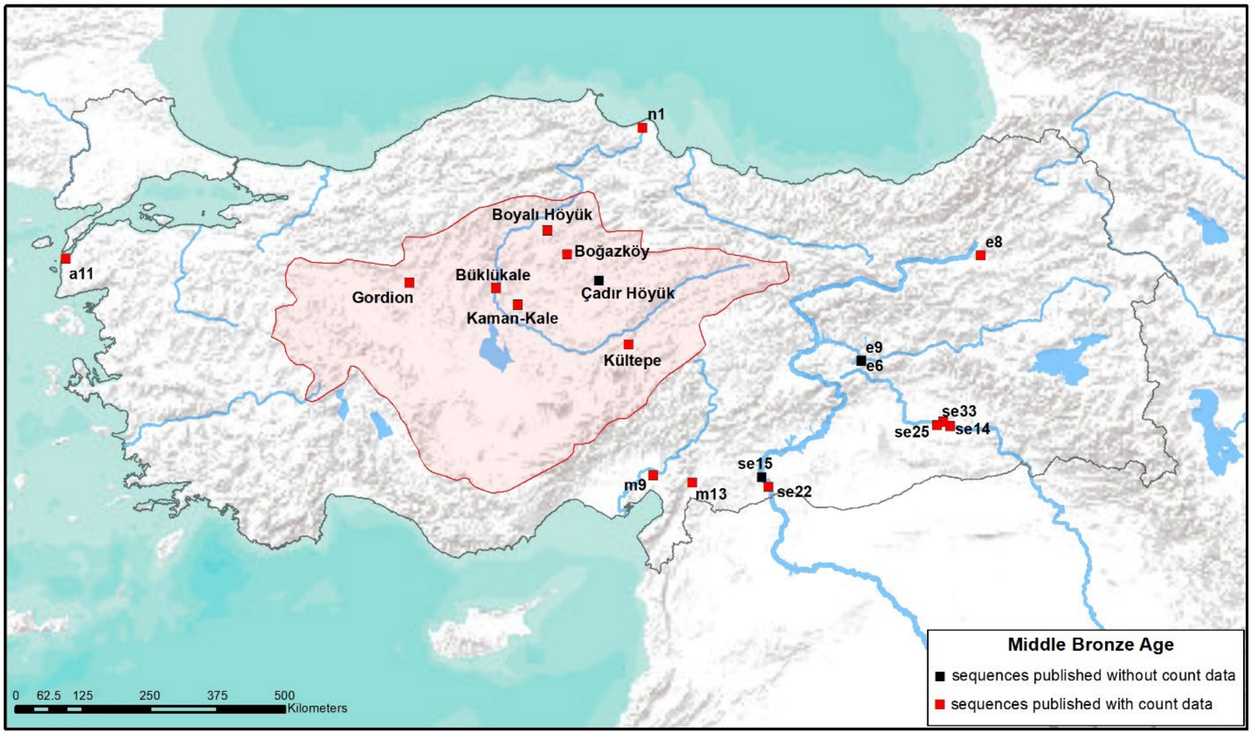
n1
Boyalı Höyük
Boğazköy
e8
a11
Gordion
Büklükale
Çadır Höyük
Kaman-Kale
e9
e6
Kültepe
se33
se25
se14
se15
m9
m13
se22
0 62.5 125 250 375 500
Kilometers
Middle Bronze Age
■ sequences published without count data
🟥 sequences published with count data

Figure 2.4 – *Sites with published archaeobotanical seed/fruit remains dating to the Middle Bronze Age. Site codes correspond to Table 2.3 and Appendix 1. Central Anatolia is marked in red.*

The Mediterranean and Aegean regions of Anatolia are terra incognita to archaeobotany during the Middle Bronze Age, with the published evidence limited to a single sample from Troy V (Riehl 1999a), and without considering here the samples from the later Troy VI (MBA/LBA transition and LBA I). More to the south, in Plain Cilicia, a single sample (not containing any economic plant remain) has been published from Tatarli Höyük (Kavak et al. 2019b). To this meagre balance, it could be added a single sample (with a very low concentrations of plant remains) from Tilmen Höyük, in the Amanus (Carra 2013). Finally, in northern Anatolia, 19 samples from Ikiztepe (van Zeist 2003) are attributed to the EBA III to MBA I transitional period.

- *Late Bronze Age* (*ca. 1600-1180 BCE*)

Table 2.4 summarizes the carpological evidence to date available for Late Bronze Age (LBA; ca. 1600-1180 BCE; Section 1.2.3) Anatolia. A total of five archaeobotanical sequences with quantitative carpological data are available for this period in central Anatolia: Boğazköy, Gordion, Kuşaklı, Ortaköy, and Kınık Höyük (Figure 2.5).

Archaeobotanical evidence from the Hittite capital, Boğazköy-*Ḫattuša*, has been published by Pasternak (2003, 3 samples; 2012, unreported number of samples) and Diffey et al. (2020; 45 samples). The latter study was conducted on the charred remains stored in the Silo-complex, the large-scale granaries dated to the Early Hittite Kingdom, located in proximity to the so-called 'Postern Wall' in the lower city of *Ḫattuša*. A limited number of samples have been published from storage contexts at the Hittite royal residence of Ortaköy-*Šapinuwa* (Oybak Dönmez 2019). A more significant number of samples (>17) are available from Kuşaklı-*Sarissa* (Müller-Karpe et al. 1995, 1998, 2000).[5] In western central Anatolia, Miller (2010) published 32 samples from LBA levels at Yassıhüyük-*Gordion*. Among the available central Anatolian evidence dating to the Late Bronze Age are to be included also two samples from the site of Niğde-Kınık Höyük, in southern Cappadocia. This latter evidence is part of the carpological study presented in Chapter 6 of the dissertation.

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[5] The number of samples analysed is not reported in Müller-Karpe et al. 1998

Three Late Bronze Age archaeobotanical sequences have been published from the Turkish sector of the Euphrates Valley: Karkemish (6 samples, having a very low concentration of plant parts; Carra 2018), Tille Höyük (2 samples; Nesbitt 2016), and Aşvan-Aşvan Kale (2 samples; Nesbitt et al. 2017). Ziyaret Tepe is currently the only site in the Tigris with published LBA carpological evidence (9 samples; Rosenzweig 2014).

Code	Site	Region	Chronology	Y/N	Samples	Reference
c1	Alaca Höyük	C-Anatolia	LBA	N	nr	Dix 1938 and 1944; Gökgöl 1938 and 1944
c5	Boğazköy	C-Anatolia	LBA	Y	>45	Diffey et al. 2020; Pasternak 2003, 2012
c9	Çadır Höyük	C-Anatolia	LBA	N	4	Smith 2007
c15	Gordion	C-Anatolia	LBA	Y	32	Miller 2010
c19	Kınık Höyük	C-Anatolia	LBA	Y	2	this study
c22	Kuşaklı	C-Anatolia	LBA	Y	>17	Müller-Karpe et al. 1995, 1998, and 2000
c24	Ortaköy	C-Anatolia	LBA	Y	2	Oybak Dönmez 2019
n3	Oymaağaç	N-Anatolia	LBA	Y	106	Czichon et al 2017; Ulaş 2019a
a5	Kaymakçı	Aegean	LBA	Y	328	Shin et al. 2021
a11	Troy	Aegean	LBA	Y	23	Riehl 1999a
m3	Kilise Tepe	Mediterranean	LBA I, LBA II	Y	35	Bending and Colledge 2007
m4	Kinet Höyük	Mediterranean	LBA	Y	31	Çizer 2006
m8	Tarsus-Gözlükule	Mediterranean	LBA	N	nr	Özyar et al. 2020
m9	Tatarlı Höyük	Mediterranean	LBA	Y	4	Kavak et al. 2019b
m10	Tell Atchana	Mediterranean	LBA	Y	328	Çizer 2006; Riehl 2010; Stirn 2013
m14	Ulu Burun	Mediterranean	LBA	N	nr	Haldane 1993, Ward 2003
tm2	Beycesultan	Tr-Mediterranean	LBA	Y	7	Helbaek 1961
se17	Karkemish	SE-Anatolia	LBA I	Y	6	Carra 2018
se28	Tille Höyük	SE-Anatolia	LBA	Y	2	Nesbitt 2016
se33	Ziyaret Tepe	SE-Anatolia	LBA	Y	9	Rosenzweig 2014
e2	Aşvan-Aşvan Kale	E-Anatolia	LBA	Y	2	Nesbitt et al. 2017
e6	Korucutepe	E-Anatolia	LBA	N	3	van Zeist and Bakker-Heeres 1975
e9	Tepecik- Elazığ	E-Anatolia	LBA	N	1	van Zeist and Bakker-Heeres 1975

Table 2.4– *List of Anatolian Late Bronze Age sites with published carpological evidence. Both records published with quantitative (Y/N=Y), or non-quantitative (Y/N=N) data are included. Further information on each site/record are available in Appendix 1.*

Tell Atchana, located in the Amuq Valley, is a key sequence in the Mediterranean district of Anatolia, with more than 328 carpological samples published (Çizer 2006; Riehl 2010; Stirn 2013). The evidence from Tell Atchana is complemented, in Plain Cilicia, by the assemblage from Kinet Höyük (31 samples; Çizer 2006). More limited (4 samples with very low counts of economic plants) is the evidence currently available from the nearby site of Tatarlı Höyük (Kavak et al. 2019b). In Rough Cilicia, 35 samples have been published from LBA Kilise Tepe (Bending and Colledge 2007), overwhelmingly from the transitional LBA-EIA occupation phase of the site (Period IIb-d).

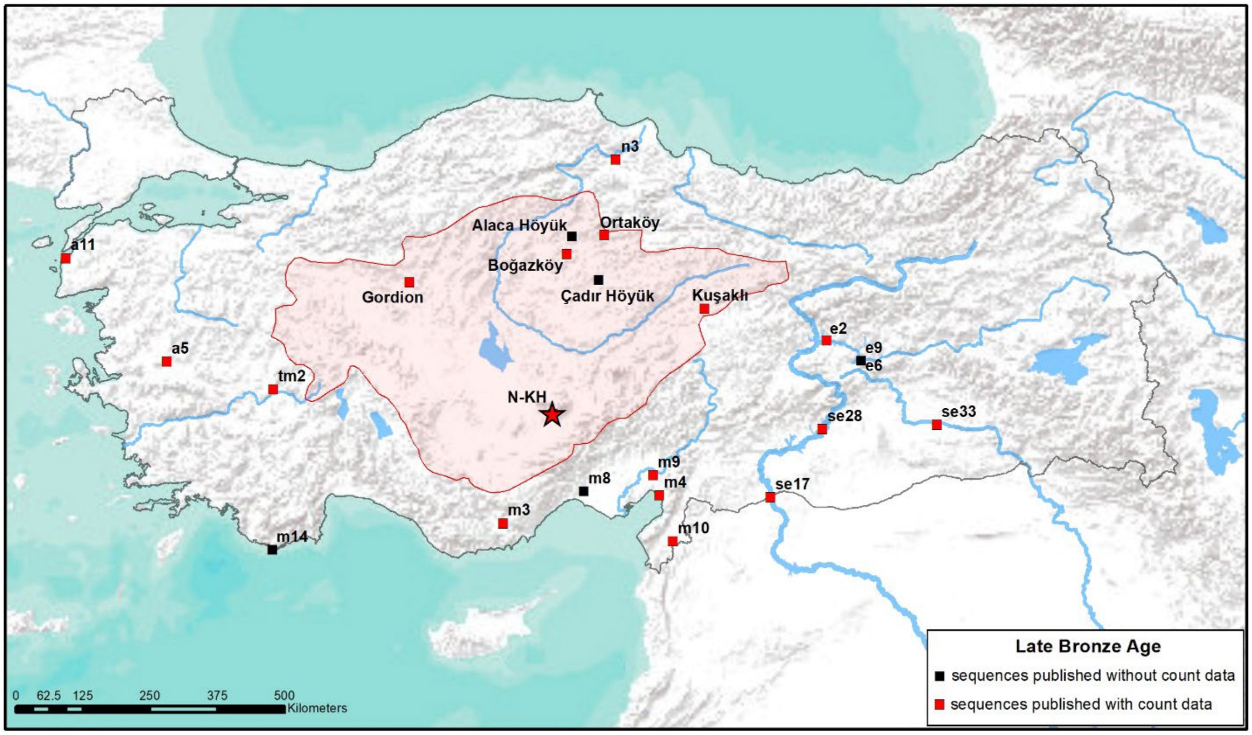
n3
Alaca Höyük
Ortaköy
Boğazköy
Çadır Höyük
Gordion
Kuşaklı
a11
a5
tm2
N-KH
e2
e9
e6
se28
se33
m9
m4
m8
se17
m3
m10
m14
0 62.5 125 250 375 500
Kilometers
Late Bronze Age
■ sequences published without count data
■ sequences published with count data

Figure 2.5 – *Sites with published archaeobotanical seed/fruit remains dating to the Late Bronze Age. Site codes correspond to Table 2.4 and Appendix 1. Central Anatolia is marked in red.*

In the Upper Meander River, Helbaek (1961) published seven samples from Late Bronze Age Beycesultan.[6] More to the west, towards the Aegean coast, intensive archaeobotanical research has been conducted at the LBA site of Kaymakçı (328 carpological samples; Shin et al. 2021). 23 samples are, furthermore, available from LBA Troy (Period VI and VIIa; e.g., Pavuk 2015) (Riehl 1999a). A final note should be made on the well-known late 14th century BCE shipwreck of Uluburun, near Bodrum (Haldane 1993).

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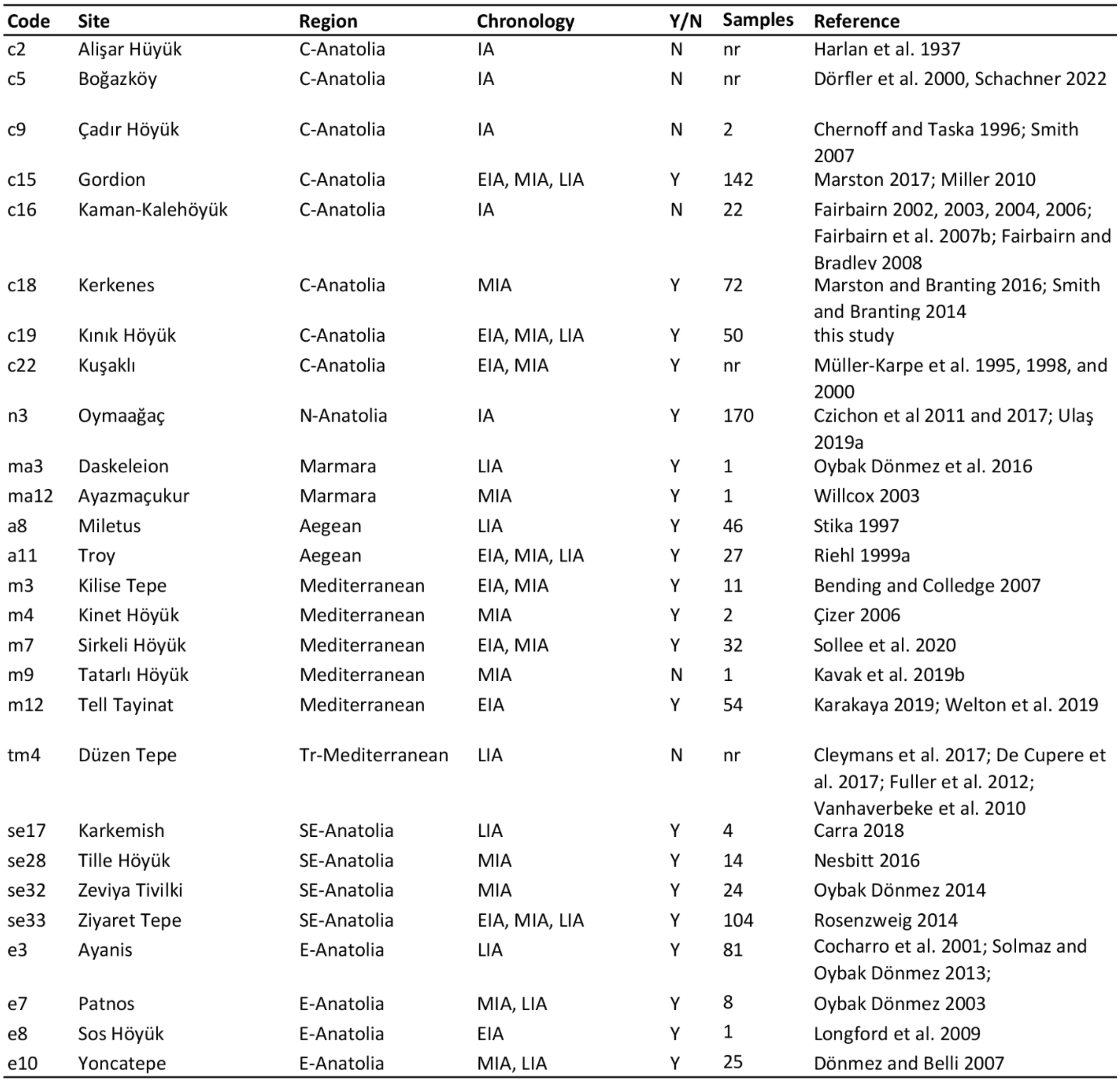
[6] The absolute dating of Bronze Age levels at Beycesultan has been called into question by a new research project (Dedeoğlu and Abay 2014). This latter research has suggested a possibly redating of Level II of Beycesultan to the Middle rather than Late Bronze Age. If this new dating is confirmed, the samples analyzed by Helbaek (1961) have to be reassigned to the MBA.

- *Iron Age* (*ca. 1180-550 BCE*)

A total of 4 carpological sequences published with quantitative data are available from Iron Age (IA; ca. 1180-550 BCE; Section 1.2.4) central Anatolia: Gordion, Kuşaklı, Kerkenes, and Kınık Höyük (Table 2.5, Figure 2.6). The site of Gordion, with 142 carpological samples spanning the entire Iron Age (Miller 2010, Marston 2017), provides a key reference sequence for the Anatolian Plateau. Carpological analysis has also been conducted on sediments coming from Iron Age (EIA and MIA) levels at Kuşaklı (number of samples not specified; Müller-Karpe et al. 1995, 1998, 2000). 72 samples have been published from the Late Phrygian (Middle Iron Age) site of Kerkenes (Smith and Branting 2014, Marston and Branting 2016). Finally, this dissertation contributes to the archaeobotanical dataset from Iron Age central Anatolia, with the analysis of 50 samples from the IA levels (KH-P VB, VA, and IV) of Niğde-Kınık Hoyük (Chapter 6).

In the eastern highlands, carpological evidence has been published from three Urartian (Middle Iron Age) sites in the Van region: Ayanis (81 samples; Cocharro et al. 2001, Solmaz and Oybak Dönmez 2013); Patnos (8 samples; Oybak Dönmez 2003); and Yoncatepe (25 samples; Oybak Dönmez and Belli 2007). A single Iron Age sample is, furthermore, available from Sos Höyük (Longford at al. 2009). In the Tigris Valley, 104 carpological samples have been published from the Neo-Assyrian occupation level of

Ziyaret Tepe (Rosenzweig 2014). More downstream on the Tigris, 24 samples (of which one contained archaeobotanical macr-remains) dating to the Middle-Assyrian period have been published from Ziviya Tivilki (Oybak Dönmez 2014). On the Euphrates River, carpological studies are available from Neo-Assyrian levels at Tille Höyük (14 samples; Nesbitt 2016) and Karkemish (4 samples, having a very low concentration of plant parts; Carra 2018).



Code	Site	Region	Chronology	Y/N	Samples	Reference
c2	Alişar Hüyük	C-Anatolia	IA	N	nr	Harlan et al. 1937
c5	Boğazköy	C-Anatolia	IA	N	nr	Dörfler et al. 2000, Schachner 2022
c9	Çadır Höyük	C-Anatolia	IA	N	2	Chernoff and Taska 1996; Smith 2007
c15	Gordion	C-Anatolia	EIA, MIA, LIA	Y	142	Marston 2017; Miller 2010
c16	Kaman-Kalehöyük	C-Anatolia	IA	N	22	Fairbairn 2002, 2003, 2004, 2006; Fairbairn et al. 2007b; Fairbairn and Bradley 2008
c18	Kerkenes	C-Anatolia	MIA	Y	72	Marston and Branting 2016; Smith and Branting 2014
c19	Kınık Höyük	C-Anatolia	EIA, MIA, LIA	Y	50	this study
c22	Kuşaklı	C-Anatolia	EIA, MIA	Y	nr	Müller-Karpe et al. 1995, 1998, and 2000
n3	Oymaağaç	N-Anatolia	IA	Y	170	Czichon et al 2011 and 2017; Ulaş 2019a
ma3	Daskeleion	Marmara	LIA	Y	1	Oybak Dönmez et al. 2016
ma12	Ayazmaçukur	Marmara	MIA	Y	1	Willcox 2003
a8	Miletus	Aegean	LIA	Y	46	Stika 1997
a11	Troy	Aegean	EIA, MIA, LIA	Y	27	Riehl 1999a
m3	Kilise Tepe	Mediterranean	EIA, MIA	Y	11	Bending and Colledge 2007
m4	Kinet Höyük	Mediterranean	MIA	Y	2	Çizer 2006
m7	Sirkeli Höyük	Mediterranean	EIA, MIA	Y	32	Sollee et al. 2020
m9	Tatarlı Höyük	Mediterranean	MIA	N	1	Kavak et al. 2019b
m12	Tell Tayinat	Mediterranean	EIA	Y	54	Karakaya 2019; Welton et al. 2019
tm4	Düzen Tepe	Tr-Mediterranean	LIA	N	nr	Cleymans et al. 2017; De Cupere et al. 2017; Fuller et al. 2012; Vanhaverbeke et al. 2010
se17	Karkemish	SE-Anatolia	LIA	Y	4	Carra 2018
se28	Tille Höyük	SE-Anatolia	MIA	Y	14	Nesbitt 2016
se32	Zeviya Tivilki	SE-Anatolia	MIA	Y	24	Oybak Dönmez 2014
se33	Ziyaret Tepe	SE-Anatolia	EIA, MIA, LIA	Y	104	Rosenzweig 2014
e3	Ayanis	E-Anatolia	LIA	Y	81	Cocharro et al. 2001; Solmaz and Oybak Dönmez 2013;
e7	Patnos	E-Anatolia	MIA, LIA	Y	8	Oybak Dönmez 2003
e8	Sos Höyük	E-Anatolia	EIA	Y	1	Longford et al. 2009
e10	Yoncatepe	E-Anatolia	MIA, LIA	Y	25	Dönmez and Belli 2007

Table 2.5– *List of Anatolian Iron Age sites with published carpological evidence. Both records published with quantitative (Y/N=Y), or non-quantitative (Y/N=N) data are included. Further information on each site/record are available in Appendix 1.*

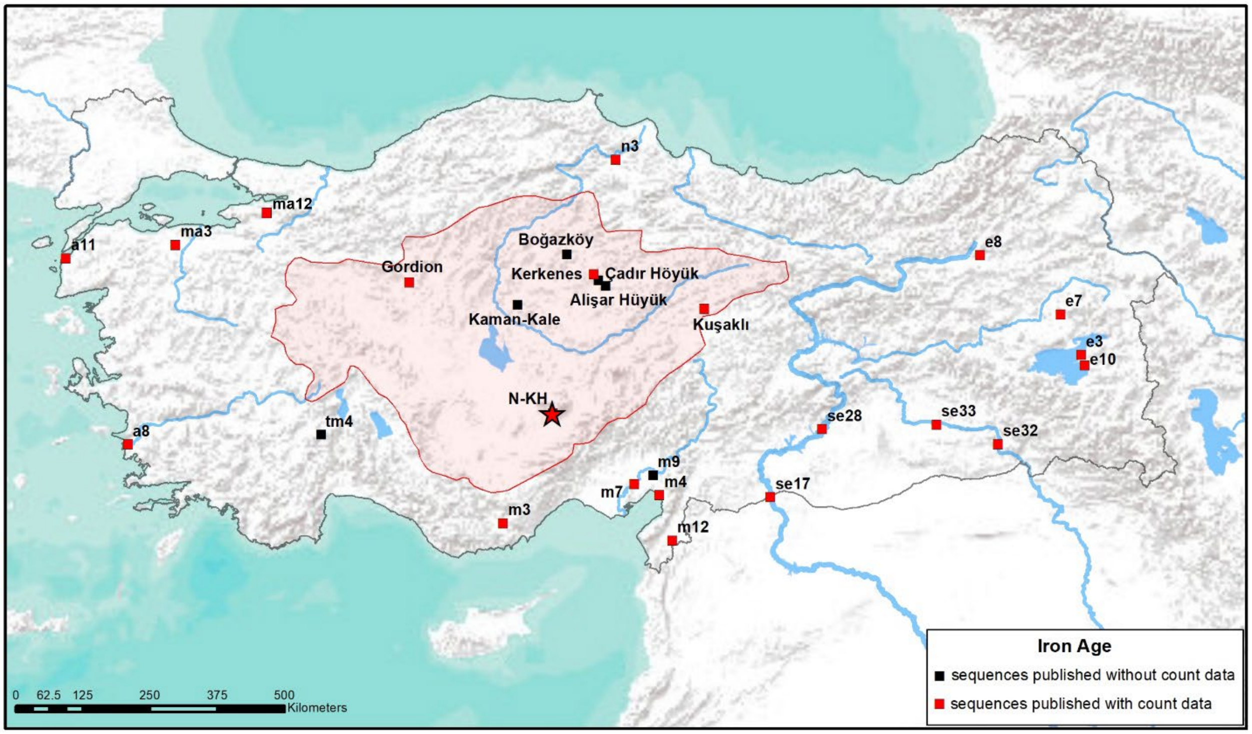

n3
ma12
a11
ma3
Boğazköy
Gordion
Kerkenes
Çadır Höyük
Alişar Hüyük
Kaman-Kale
Kuşaklı
e8
e7
e3
e10
N-KH
se28
se33
se32
a8
tm4
m9
m7
m4
se17
m3
m12
0 62.5 125 250 375 500 Kilometers
Iron Age
■ sequences published without count data
■ sequences published with count data

Figure 2.6 – *Sites with published archaeobotanical seed/fruit remains dating to the Iron Age. Site codes correspond to Table 2.5 and Appendix 1. Central Anatolia is marked in red.*

In the Amuq Valley, 54 carpological samples have been published from the Early Iron Age levels of Tell Taynat (Karakaya 2019, Welton et al. 2019). In Plain Cilicia, the largest Iron Age carpological assemblage originates from Early and Middle Iron Age phases at Sirkeli Höyük (32 samples; Sollee et al. 2020), which is complemented by more limited evidence (2 samples) from Middle Iron Age Kinet Höyük (2 samples; Çizer 2006). 11 samples dating to the Early and Middle Iron Age are published from Kilise Tepe (Bending and Colledge 2007), in Rough Cilicia. On the Aegean coast, 46 carpological samples from the Archaic occupation of Miletus are available (Stika 1997). While at Troy, a total of 27 samples are attributed to Period VIIb1-3 (Early to Late Iron Age) and VIII (Archaic) (Riehl 1999a). In the Marmara region, 1 samples (with a low concentration of plant parts) are published from Archaic levels of Daskeleion (Oybak Dönmez et al. 2016), and a single sample is available from Ayazmaçukur (Willcox

2003). Finally, in preliminary publications, 170 carpological samples have been published from Iron Age Oymaağaç (Czichon et al 2011, 2017, Ulaş 2019a), without providing, however, a more precise chronological attribution.

- *Achaemenid and Hellenistic Periods* (*ca. 550-1 BCE*)

The carpological coverage of central Anatolia during the Achaemenid and Hellenistic periods (ca. 550-1 BCE; Section 1.2.6) is extremely poor. Prior to the archaeobotanical study presented in this dissertation (Kınık Höyük, 95 samples; Chapter 6), Gordion represented the only published Hellenistic carpological sequence from the entire Anatolian Plateau (226 samples; Miller 2010, Marston 2017).

Code	Site	Region	Chronology	Y/N	Samples	Reference
c15	Gordion	C-Anatolia	Ach/Hell	Y	226	Marston 2017; Miller 2010
c19	Kınık Höyük	C-Anatolia	Ach/Hell	Y	95	This study
c25	Pessinonte	C-Anatolia	Hell	Y	2	van Peteghem 2005 and 2008; van Peteghem and Braeckman 2001
n3	Oymaağaç	N-Anatolia	Hell/Rom	Y	5	Czichon et al. 2017
ma3	Daskeleion	Marmara	Ach/Hell	Y	3	Oybak Dönmez et al. 2016
ma12	Ayazmaçukur	Marmara	Hell	Y	1	Willcox 2003
a3	Ephesus	Aegean	Hell	Y	1	Heiss and Thanheiser 2016
a11	Troy	Aegean	Ach/Hell	Y	5	Riehl 1999
m9	Tatarlı Höyük	Mediterranean	Hell	Y	38	Aslan 2012
tm4	Düzen Tepe	Tr-Mediterranean	Hell	N	nr	Cleymans et al. 2017; De Cupere et al. 2017; Fuller et al. 2012
tm9	Sagalassos	Tr-Mediterranean	Hell	N	nr	Poblome et al. 2015; De Cupere et al. 2017; Fuller et al. 2012; Vandam et al. 2019; Verstraeten et al. 2011
se17	Karkemish	SE-Anatolia	Hell	Y	1	Carra 2018
se28	Tille Höyük	SE-Anatolia	Hell	Y	4	Nesbitt 2016
e2	Aşvan Kale	E-Anatolia	Hell	Y	22	Nesbitt et al. 2017

Table 2.6– *List of Anatolian Achaemenid and Hellenistic sites with published carpological evidence. Both records published with quantitative (Y/N=Y), or non-quantitative (Y/N=N) data are included. Further information on each site/record are available in Appendix 1.*

To the evidence from Gordion, we can add a very limited number of samples, having a very low concentration of plant parts, available from Pessinonte (2 samples; van Peteghem 2005, 2008, van

Peteghem and Braeckman 2001). The carpological record from Sagalassos (e.g., Poblome et al. 2015, De Cupere et al. 2017, Fuller et al. 2012, Vandam et al. 2019, Verstraeten et al. 2011) and Düzen Tepe (Cleymans et al. 2017, De Cupere et al. 2017, Fuller et al. 2012), in the Lake District, remains to date only preliminary published, without quantitative data.

The Hellenistic period is unsatisfactory sampled by archaeobotanical research also elsewhere in Asia Minor. On the Euphrates River, Hellenistic carpological data are available from Tille Höyük (4 samples; Nesbitt 2016) and Aşvan Kale (22 samples; Nesbitt et al. 2017). A single sample, with a very low concentration of plant remains, has been published also from Karkemish (Carra 2018).

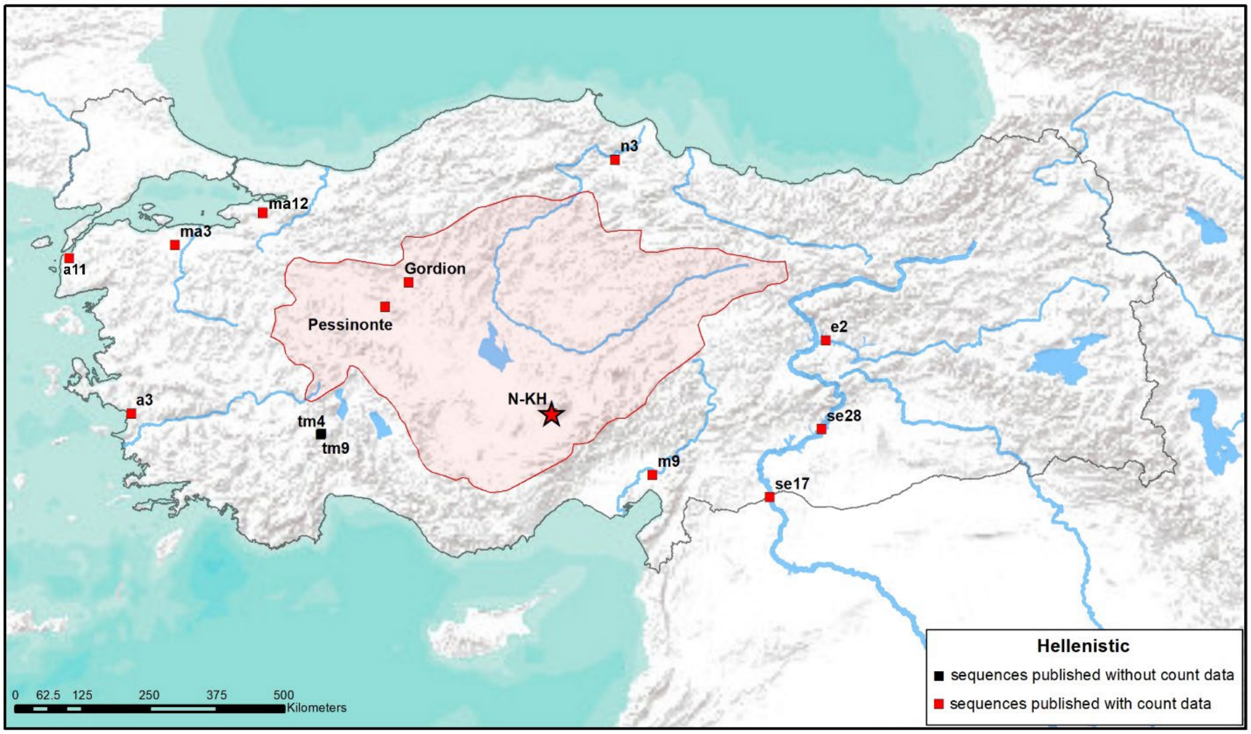

n3
ma12
ma3
a11
Gordion
Pessinonte
e2
N-KH
a3
tm4
tm9
se28
m9
se17
Hellenistic
■ sequences published without count data
■ sequences published with count data
0 62.5 125 250 375 500
Kilometers

Figure 2.7 – *Sites with published archaeobotanical seed/fruit remains dating to the Achaemenid and Hellenistic Period. Site codes correspond to* Table 2.6 *and* Appendix 1. *Central Anatolia is marked in red.*

In Plain Cilicia, 38 carpological samples are available from Tatarli Höyük (Aslan 2012). Only a single carpological sample from Ephesus, on the Aegean coast, dates to the Hellenistic period (Heiss and Thanheiser 2016); while 5 samples from Troy are attributed to the Classic and Hellenistic periods (Riehl 1999). To this meagre balance, we can add three samples from Daskaleion (Oybak Dönmez et al. 2016), a single sample from Ayazmaçukur (Willcox 2003), and five samples from Oymaağaç – which are dated in preliminary publications to the "Hellenistic/Roman" period (Czichon et al 2017).

2.1.4 *A Survey of the central Anatolian archaeobotanical literature: anthracological records*

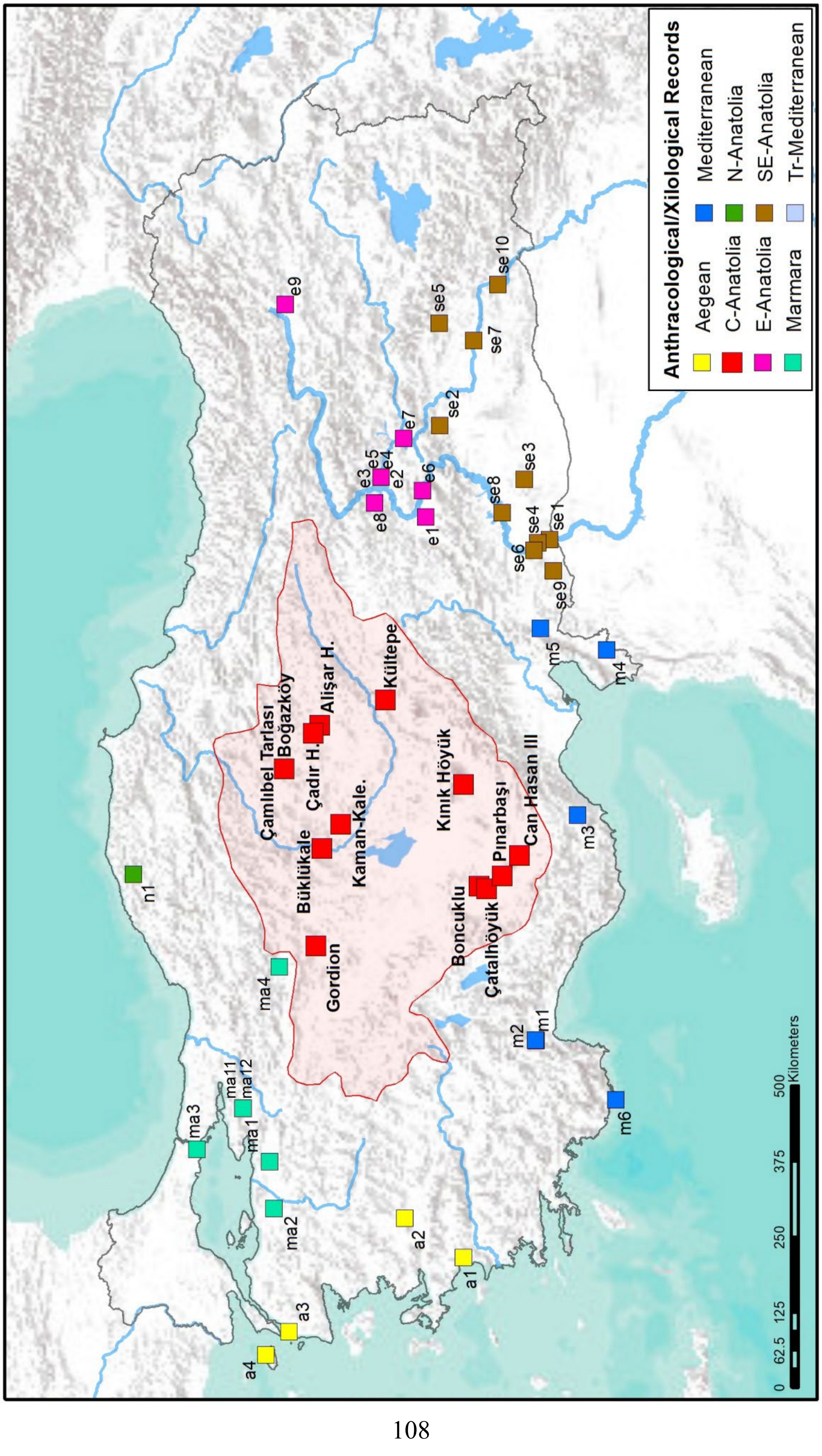
As noted in Section 2.1.1, in addition to seed and fruit remains, wood charcoal represents a second type of archaeobotanical macro-remain ubiquitously and abundantly found in archeological stratifications. Despite the abundance of wood charcoal at archaeological sites, anthracological research has been conducted at only a few Anatolian sites.

Complementing the discussion provided for carpological remains, in the following paragraphs I will systematically review the published literature containing quantitative wood charcoal data. I will first provide a general survey, spanning the entire modern area of Turkey from the Paleolithic to the Medieval period (Table 2.7, Figure 2.8). While in a second part of this section, I will introduce in more detail the wood charcoal records attributed to the time window comprising the Early Bronze Age to the end of the Hellenistic period.

In Appendix 2, I have provided a complete list of Anatolian sites with published anthracological evidence, including site coordinates, climatological data, period covered by the archaeobotanical study, and bibliographic references.

(Next page) Table 2.7 – *Anthracological/xylological data from Anatolia. For further information see Appendix 2. The evidence from the sites reported in parenthesis has not yet been quantitatively published.*

	Central	Southeasten	Eastern	Mediterranean	Aegean	Tr. Med.	Marmara	Northern
Epipaleolithic *(pre 9,700 BCE)*	Pınarbaşı	Körtik Tepe	—	Karain B; Okuzini	—	—	—	—
Aceramic Neolithic *(c. 9,700 – 7,000 BCE)*	Boncuklu; Can Hasan III; Çatalhöyük; Pınarbaşı	Akarçay Tepe; Çayönü Tepesi; Göbekli Tepe; (Hallan Çemi Tepesi); Körtik Tepe	Cafer Höyük	—	—	—	—	—
Ceramic Neolithic *(c. 7,000 – 6,000 BCE)*	Çatalhöyük; Pınarbaşı	Akarçay Tepe; Çayönü Tepesi	—	—	—	—	Aktopraklık	—
Early Chalcolithic *(c. 6,000 – 5,400 BCE)*	Çatalhöyük; Pınarbaşı	Akarçay Tepe	—	—	—	—	Aktopraklık	—
Middle Chalcolithic *(c. 5,400 – 4,500 BCE)*	—	—	—	—	—	—	—	—
Late Chalcolithic *(c. 4,500 – 3,000 BCE)*	Çamlıbel Tarlası	Hacinebi	Arslantepe; Aşvan; (Korucutepe); Sos Höyük	—	—	—	—	—
Early Bronze Age *(c. 3,000 – 2,000 BCE)*		Horum Höyük; Kurban Höyük; Tilbeşar	Arslantepe; Aşvan; (Korucutepe)	—	(Yenibademli Höyük)	—	—	—
Middle Bronze Age *(c. 2,000 – 1,600 BCE)*	Büklükale; Kaman-Kaleöyük; Kültepe	Horum Höyük; Tilbeşar	(Korucutepe); Sos Höyük	(Tilmen Hoyuk)	—	—	—	—
Late Bronze Age *(c. 1,600 – 1,200 BCE)*	(Boğazköy); Gordion; Kaman-Kaleöyük; Kınık Höyük	—	Aşvan; (Korucutepe)	Tell Atchana; (Ulu Burun)	Kaymakçı	—	—	—
Iron Age *(c. 1,200 – 300/200 BCE)*	(Alişar Höyük); Gordion; Kaman-Kaleöyük; Kınık Höyük	(Zeviya Tivilki)	Aşvan; Sos Höyük	—	—	—	Ayazmaçukur	—
Hellenistic *(c. 300/200 – 1 BCE)*	Gordion; Kınık Höyük	—	Aşvan	—	Ephesus	—	(Daskeleion)	—
Roman *(c. 1 – 400 CE)*	Gordion	—	Aşvan	—	Ephesus	—	(Juliopolis)	—
Byzantine/Abassid *(c. 400 – 1100/1200 CE)*	Çadır Höyük; Gordion; Kınık Höyük	(Tilbeşar)	—	—	—	—	Yenikapi	(Ilgarini)
Seljuk/Ottoman *(after 1100/1200 CE)*	Gordion	—	Aşvan; (Korucutepe); (Onar)	—	—	—	Dikilitaş	—



Anthracological/Xilological Records
🟨 Aegean
🟥 C-Anatolia
🟪 E-Anatolia
🟩 Marmara
🟦 Mediterranean
🟩 N-Anatolia
🟫 SE-Anatolia
🟦 Tr-Mediterranean
Çamlıbel Tarlası
Boğazköy
Alişar H.
Çadır H.
Kültepe
Kaman-Kale.
Büklükale
Gordion
Kınık Höyük
Pınarbaşı
Can Hasan III
Boncuklu
Çatalhöyük
n1
ma1
ma2
ma3
ma4
ma11
ma12
a1
a2
a3
a4
m1
m2
m3
m4
m5
m6
e1
e2
e3
e4
e5
e6
e7
e8
e9
se1
se2
se3
se4
se5
se6
se7
se8
se9
se10
0
62.5
125
250
375
500
Kilometers

(Previous page) Figure 2.8 – *Sites with published anthracological/xylological data, by region* (*see Chapter 1*). *Site codes correspond to Appendix 2. Ecological regions are delineated after Atalay 2014. Central Anatolia is marked in red.*

- *Anthracological sequence from the Early Bronze Age to the Hellenistic period* (*ca. 3000-1 BCE*)

For the entire period comprised between the beginning of the 3rd to the end of the 1st millennium BCE, only five anthracological sequences have been published from the Central Anatolian Plateau: Gordion, Kaman-Kalehöyük, Kültepe, Büklükale, and Niğde-Kınık Höyük (Table 2.8, Figure 2.9). Evidence from this latter site, originating as part of this dissertation project, is presented in Chapter 5.

The anthracological study conducted at Gordion covers the period from the Late Bronze Age to the Middle Ages, with a total of more than 653 samples published thus far (Miller 2010, Marston and Miller 2014, Marston 2017). Equally intensively studied is the site of Kaman-Kalehöyük, with 118 samples spanning from the Middle Bronze Age to the end of the Iron Age (Wright et al. 2015 and 2017, Wright 2018). This dissertation provides a third anthracological reference sequence for central Anatolia, with 174 samples analyzed from the site of Niğde- Kınık Hoyük (Castellano 2021) (Chapter 5). In addition to the aforementioned sequences, which cover part of the 2nd millennium and the whole (Gordion and Niğde- Kınık Hoyük) or most (Kaman-Kalehöyük) of the 1st millennium BCE, anthracological research has been conducted on Middle Bronze Age levels from Kültepe (20 samples; Fairbairn and Wright 2017) and Büklükale (4 samples; Fairbairn et al. 2019) (Table 2.8, Figure 2.9).

Moving outside central Anatolia, in the Upper-Middle Euphrates, wood charcoal analyses have been conducted at Tilbeşar (EBA, MBA; 25 samples), Horum Höyük (EBA, MBA; 20 samples) (Deckers and Pessin 2010), and Kurban Höyük (EBA; 18 samples; Algaze et al 1996). In the Upper Euphrates, intensive research has been conducted at the site of Arslantepe, with 118 samples originating from the EBA levels (Sadori et al. 2006, 2008, Alvaro et al. 2010, Masi et al. 2018, Piccione et al. 2015). Willcox (1974) published an unreported number of samples from the sites of Aşvan Kale (EBA, LBA, Hellenistic) and Taşkun Mevkii (EBA).

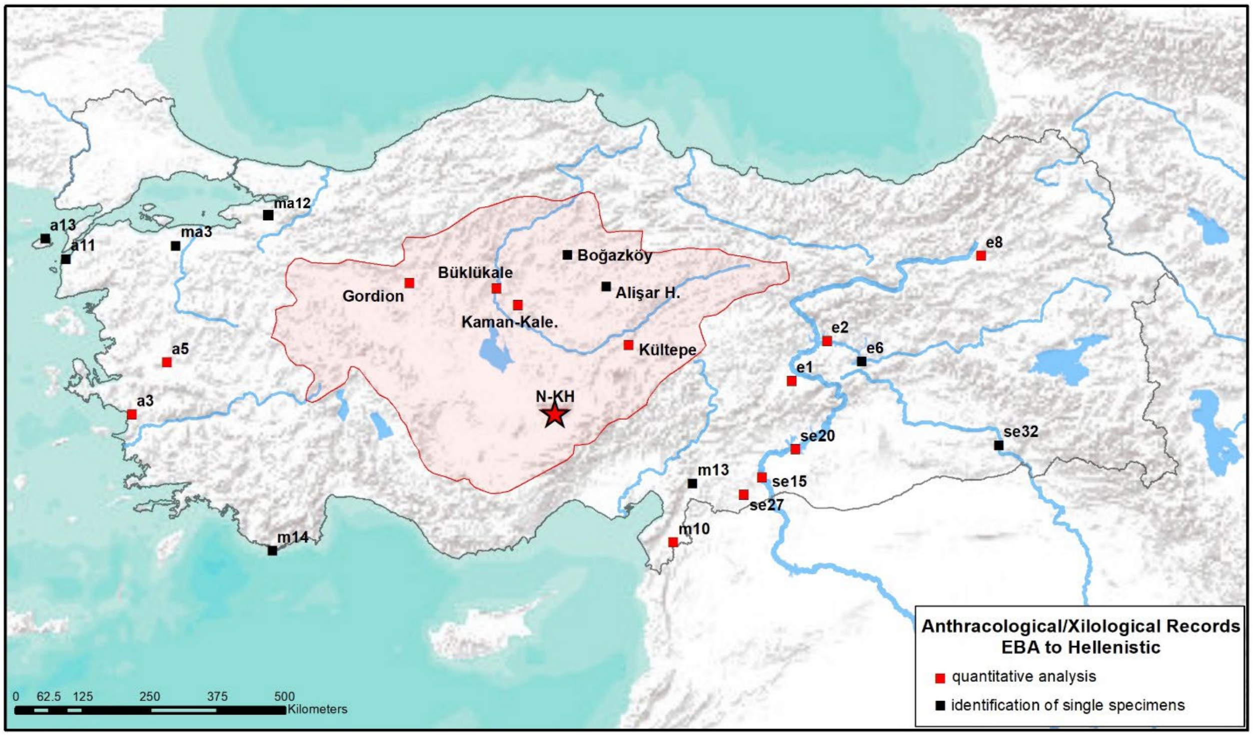

ma12
a13
a11
ma3
Boğazköy
Büklükale
Gordion
Alişar H.
Kaman-Kale.
Kültepe
a5
a3
N-KH
e8
e2
e6
e1
se20
se32
m13
se15
se27
m10
m14
Anthracological/Xilological Records
EBA to Hellenistic
🟥 quantitative analysis
■ identification of single specimens
0
62.5
125
250
375
500
Kilometers

Figure 2.9– *List of Anatolian sites dated from the Early Bronze Age to the Hellenistic period with published anthracological evidence. Both records published with quantitative (Y/N=Y), or non-quantitative (Y/N=N) data are included. Further information on each site/record are available in Appendix 2.*

In the eastern Anatolian highland, two samples have been analyzed from Middle Bronze and Early Iron Age levels of Sos Höyük (Longford et al. 2009). In proximity to the Mediterranean coast, in the Amuq Valley, 68 samples have been published from the Late Bronze Age levels of Tel Atchana (Deckers 2010). In the Aegean region, wood charcoal analysis has been conducted at the Late Bronze Age site of Kaymakçı (87 samples; Marston et al. 2021) and Hellenistic levels from Ephesus (Heiss and Thansheiser 2016, 2020, Heiss 2016).

Code	Site	Region	Chronology	Y/N	Samples	Reference
c2	Alişar Höyük	C-Anatolia	IA	N	nr	Record et al 1937
c5	Boğazköy	C-Anatolia	LBA	N	nr	Hopf 1992
c8	Büklükale	C-Anatolia	MBA	Y	4	Fairbairn et al. 2019
c15	Gordion	C-Anatolia	LBA, EIA, IA, Hell.	Y	>653	Aytuğ 1988; Aytuğ and Gorcelioğlu 1989; Kayacik and Aytuğ 1968; Miller 2010; Marston and Miller 2014; Marston 2017
c16	Kaman-Kaleöyük	C-Anatolia	MBA, LBA, IA	Y	118	Wright et al. 2015 and 2017; Wright 2018
c19	Kınık Höyük	C-Anatolia	LBA, IA, Hell.	Y	174	Castellano 2021
c21	Kültepe	C-Anatolia	EBA, MBA	Y	20	Fairbairn and Wright 2017
a3	Ephesus	Aegean	Hell.	Y	6	Heiss and Thanheiser 2016; Heiss 2016; Heiss and Thanheiser 2020
a5	Kaymakçı	Aegean	LBA	Y	87	Marston et al. 2021
a11	Troy	Aegean	BA	N	nr	Shay et al. 1992
a13	Yenibademli Höyük	Aegean	EBA	N	nr	Yaman 2011; Yaman and Hüryilmaz 2014
e1	Arslantepe	E-Anatolia	EBA	Y	118	Frangipane et al 2001; Sadori et al. 2006; Sadori et al 2008; Alvaro et al 2010; Masi et al 2018; Piccione et al. 2015
e2	Aşvan-Aşvan Kale	E-Anatolia	EBA, LBA, Hell.,	Y	nr	Willcox 1974
e2	Aşvan-Taşkun Mevkii	E-Anatolia	EBA	Y	nr	Willcox 1974
e6	Korucutepe	E-Anatolia	EBA, MBA, LBA	N	43	van Zeist and Bakker-Heeres 1974; van Zeist and Bakker-Heeres 1975;
e8	Sos Höyük	E-Anatolia	MBA, EIA	Y	2	Longford et al. 2009
ma3	Daskeleion	Marmara	Hell.	N	nr	Yaman et al. 2013
ma12	Ayazmaçukur	Marmara	MIA	Y	1	Willcox 2003
m10	Tell Atchana	Mediterranean	LBA	Y	68	Deckers 2010
m13	Tilmen Hoyuk	Mediterranean	MBA	N	nr	Macchioni and Lazzeri 2013
m14	Ulu Burun	Mediterranean	LBA	N	nr	Warnock and Pendleton 1991
se15	Horum Höyük	SE-Anatolia	EBA, MBA	Y	20	Willcox 2002; Deckers and Pessin 2010
se20	Kurban Höyük	SE-Anatolia	EBA	Y	18	Algaze et al. 1986
se27	Tilbeşar	SE-Anatolia	EBA, MBA, Med I	Y	25	Kavak et al. 2018; Willcox 2002; Deckers and Pessin 2010
se32	Zeviya Tivilki	SE-Anatolia	IA	N	nr	Yaman 2014

Table 2.8–*Anatolian sites dated from the Early Bronze Age to the Hellenistic period with published anthracological evidence. Further information on each site/record are available in Appendix 2.*

2.2 The fossil pollen record

The study of stratified fossil pollen and spores (palynomorphs) represents one of the main methods for reconstructing Quaternary paleoenvironments and vegetation (Seppä 2013). Pollen grains are composed by a resistant outer layer, the exine, which warrants preservation of the grains in non-oxidizing and non-alkaline environments (Traverse 2007). The quantitative study of fossil pollen can, thus, inform on vegetation history, at different chronological and spatial scales of analysis. In the following paragraphs, I will provide a brief introduction to the field of palynology (Section 2.2.1). This methodological premise will be followed by a systematic literature review of the published Holocene palynological evidence from Anatolia (Section 2.2.2), with a particular emphasis given to the sequences covering the period investigated by the dissertation project – i.e., from 3000 to 1 BCE.

2.2.1 *Palynology: methods, questions, limits*

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In seed plants (spermatophyte) pollen is the sporophyte containing the male gamete (Evert and Eichhorn 2013: 152-173). In flowering plants (angiosperms) pollen is formed in microsporangia present in the anthers – i.e., in the male portion of a flower (Evert and Eichhorn 2013: 457-467). While, in most gymnosperms, microsporangia are located on reduced leaves (microsporophylls) present on male cones (microstrobili) (Evert and Eichhorn 2013: 430-458).

Pollination is the process of transfer of pollen (the male gametophyte) from its site of production (male) to the ovule-bearing (female) organ. Successful pollination results in fertilization. Spermatophytes, through evolution, adapted in order to maximize the likelihood of successful pollination, by favoring the entire process to occur within a single perfect flower (self-pollination), optimizing pollen dispersal through wind (anemophily) or animals (zoophily), or by the benefiting of more than one vector (facultative pollination type) (Evert and Eichhorn 2013: 477-500).

Wind-pollinated plants produce large quantities of pollen grains/spores, which are shed during the flowering season, dispersed into the atmosphere, and for there eventually being deposited in different portions of the landscape. This process of atmospheric pollen deposition is referred as 'pollen rain' (Traverse 2007: 502-509). In a variety of depositional environments, especially under reducing and acid conditions, the deposited pollen can preserve in fossil/sub-fossil form (Traverse 2007: 501). Stratified fossil pollen evidence represents a paleoenvironmental archive, which informs on past vegetation, climate, and, broadly speaking, ecology (e.g., Birks and Birks 2004, and references therein).

The history of palynological is well covered in the literature, most recently by Birks and Berglund (2018). The latter authors recognized the presence of three main phases in the development of palynology: (*i*) a 'Pioneer Phase', from 1916 to 1950. The beginning of this phase corresponds to Lennard von Post (1884-1951) lecture given in Kristiania (Oslo), which is regarded as the 'official' beginning of Quaternary pollen analysis: in this 1916 lecture, the Swedish ecologist and geologist presented, for the first time, fossil pollen evidence in the form of percentages, thus opening to the use of palynology as a tool for quantitative reconstructions of past vegetation (von Post 1918); (*ii*) a 'Building Phase', from 1951 to 1973. This phase begins with the publication of the *Text-book of Modern Pollen Analysis* (Fægri and Iversen 1950), which provided the field standards in terms of sampling, pollen extraction, identification, and interpretation of pollen data; (*iii*) a 'Mature Phase', after 1974. This phase is characterized by advancements in dating, identification, and quantitative elaboration of pollen data. The introduction of the Accelerator Mass Spectrometry (AMS) allowed to apply radiocarbon dating to comparatively small amounts of organic materials, which in turn promoted the elaboration of more precise and reliable age-depth models. An expansion in modern pollen reference collections, combined by advancement in microscopic techniques, promoted more accurate and standardized identification. In this context, extensive palynological flora were published for the first time – including, for example, the massive *North-West European Pollen Flora* (Punt et al. 1976–2009). Finally, the introduction of personal computers and of statistical methods promoted a new emphasis on quantitative reconstructions, which progressively gained centrality in the field of Quaternary paleoecology (Birks et al. 2012, and references therein).

It is outside of the scopes of this section to provide a thorough methodological introduction to the study of fossil pollen, given the breadth and complexity of the field. For such an introduction, I refer the reader to the available literature (e.g., Fægri et al. 1989, Traverse 2007, Jansonius and McGregor 1996). More specifically the use of palynological approaches in archaeological research is discussed, among others, by Bryant and Holloway (1983, 1996), Holloway and Bryant (1986), Davis (1994), and summarized by Pearsall (Pearsall 2015: 191-194, with further literature).

From an archaeological standpoint, palynological records could be classified into *on-site* and *off-site* sequences (Edwards 2016). The former include deposits with formations directly determined by human activities – e.g., archaeological layers, organic crusts and residues, coprolites (Bryant and Holloway 1983). Off-site records, on the contrary, are associated with natural sequences in which the depositional environment is not directly connected to anthropogenic processes. These latter sequences, most commonly from liminic or waterlogged deposits, can provide comparatively continuous pollen records, which illuminate on vegetation history and on human activities conducted in the broader landscape (Deza-Araujo et al. 2020). Throughout this section I will concentrate on off-site pollen records, which represent overwhelmingly the majority of the palynological sequences available from the Anatolian Peninsula (Section 2.2.2).

As I already mentioned, the so-called "pollen rain" represents the main pathway for pollen deposition over a landscape. Wind-pollinated plants shed large amounts of pollen during the flowering season, with only a very limited amount of these grains actually fulfilling their reproductive role. Pollen in air suspension is mixed by atmospheric turbulence, a process that promotes a comparatively uniform composition of the pollen rain deposited over a specific area. If pollen deposition occurs in anoxic environments (e.g., bogs, lakes, fens, ocean floors, and other waterlogged contexts), the decay process is either slowed or inhibited – promoting preservation (Traverse 2007). The quantitative analysis of stratified pollen from such contexts represents the main concern of Quaternary palynology (Traverse 2007: 163-496).

The interpretation of a pollen assemblage relies on a proper understanding of the taphonomic processes determining their formation – from production and shedding of the palynomorphs, to their incorporation in the sediment and subsequent post-depositional history (Traverse 2007: 502). In the instances in which the pollen rain is the main vector of deposition, I would expect there to be a lack, or strong under-representation, of taxa dominantly zoophilous or self-pollinators. Different wind-pollinated taxa, furthermore, contribute differently to the pollen rain (Traverse 2007: 502-509). Among several factors, the degree of over/under-representation of a species in the pollen rain could be determined by: (*i*) the anatomy and growing location of the plant – for example, in forested landscapes important differences are found in the quantity of pollen released in the atmosphere from canopy and understory vegetation; (*ii*) the anatomy of the flower – e.g., the quantity of pollen produced in an anther and the number of anthers present in flower; and (*iii*) pollen anatomy, which impacts the deposition distance of a pollen grain – e.g., size, protoplasmic content, aerodynamic properties, and possible presence of air spaces within the pollen grain (e.g., sacci in several gymnosperms) (Traverse 2007: 497-538). Seasonal and yearly climatic variability, furthermore, impacts in a variable degree the quantity of pollen produced by single individuals (e.g., van der Knaap et al. 2010).

Once deposited on a water surface, pollen overall behaves as sedimentary particles, with grains generally undergoing a degree of mixing prior to stratification on the floor of the water body. In these instances, it is expected that at different sampling locations, contemporaneous lake sediments return comparatively homogeneous pollen assemblages, reflecting a regional rather than local deposition (Traverse 2007: 502-513). On the contrary, in bogs and marshlands pollen assemblages tend to represent a more localized image (Traverse 2007: 502-513). In large lakes and marine settings, water-borne pollen represents an additional important depositional pathway: streams, rivers, and currents are, in fact, sources of further pollen deposition. In addition to represent depositional vectors of allochthonous pollen rains, rivers and streams introduce in the sedimentary environment pollen originating from eroded deposits (Traverse 2007: 502-513). Based on these considerations, small lakes and ponds are generally regarded as favorable sampling location for pollen analysis of Quaternary deposits (e.g., Sugitta 1994).

I already noted that anoxic conditions are particularly important for the preservation of pollen grains. Preservation of pollen grains is, furthermore, favored by low pH (acid) conditions in the depositional environment. Given the same depositional context, differences in preservation are further determined by species-specific properties. In these regards, of particular importance is the amount of sporopollenin present in the exine, which mostly correlates to its thickness (e.g., Cushing 1967). Taxa having a low sporopollenin content are expected to be either under- or non-represented also in favorable (waterlogged) depositional environments – a textbook example in this regard is the genus *Populus*, which produces very delicate pollen grains, containing low quantities of sporopollenin (Cushing 1967). Although anoxic conditions warrant preservation of pollen grains, the latter can occur also in soil and other non-waterlogged depositional environments. In soil, however, poor preservation is expected, with a bias towards the over-representation of more resistant pollen grains. In these latter deposits it is further to be considered a degree of vertical redistribution of pollen grains, due to down-washing, earthworms, and other pedogenic processes (Dimbleby 1957). Considering these issues, pollen data from soil profiles will not be included in the literature review provided in Section 2.2.2.

The presence of over-, under-, and non-represented taxa prevent a direct interpretation of pollen data in terms of past vegetation reconstructions. Palynological research, accordingly, relies on the observation of modern production, dispersal, and deposition of pollen grains in order to extrapolate models that could be applied to the fossil record, which opens to the possibility to develop quantitative palaeoecological interpretation. For small lakes and ponds, such models have been proposed, among other, by Prentice (1985), Sugita (1994), and Davis (2000). I shall emphasize that the direct contribution of palynological research to the study of past agricultural practices is limited by the under- and/or non-representation in the pollen rain of several important crops, which are dominantly zoophilous (e.g., several rosaceous trees/shrubs) or self-pollinators (e.g., most cereals and pulses).

2.2.2 *Holocene pollen sequences from Anatolia*

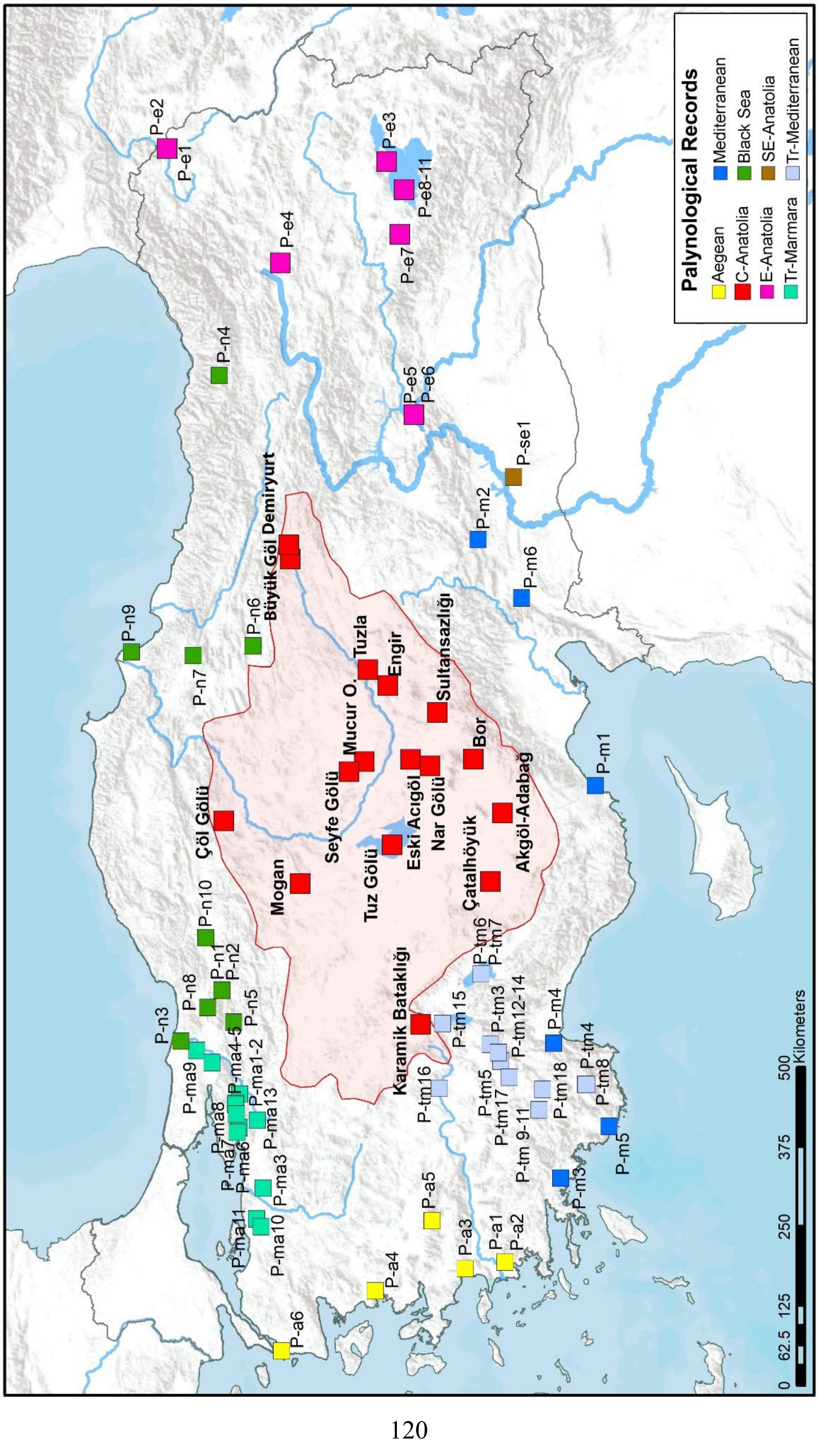
This review will cover Holocene sequences originating from waterlogged or limnic deposits. Pollen assemblages from soil profiles (e.g., Özalp et al. 2017) and marine deposits (e.g., Mudie et al. 2002) are not included, due to their different taphonomy (Traverse 2007). The published pollen sequences, meeting the aforementioned criteria, are listed in Table 2.9 and located on map in Figure 2.10.

The German palynologist Hans-Jürgen Beug published the first pollen records from Anatolia, namely at Abant Gölü and Yeniçağa Gölü in the Marmare region (Beug 1967). The establishment of palynological research in Asia Minor is, however, closely connected to the work conducted by a research group based at the *Biologisch-Archaeologisch Instituut* (University of Groningen) and under the leadership of Willem van Zeist, Sytze Bottema, and Henk Woldring (see Section 2.1.2). The research conducted by the Groningen team resulted on the publication of five main articles, which contain Late Glacial and Holocene pollen sequences from different regions of the Anatolian Peninsula: in 1970, van

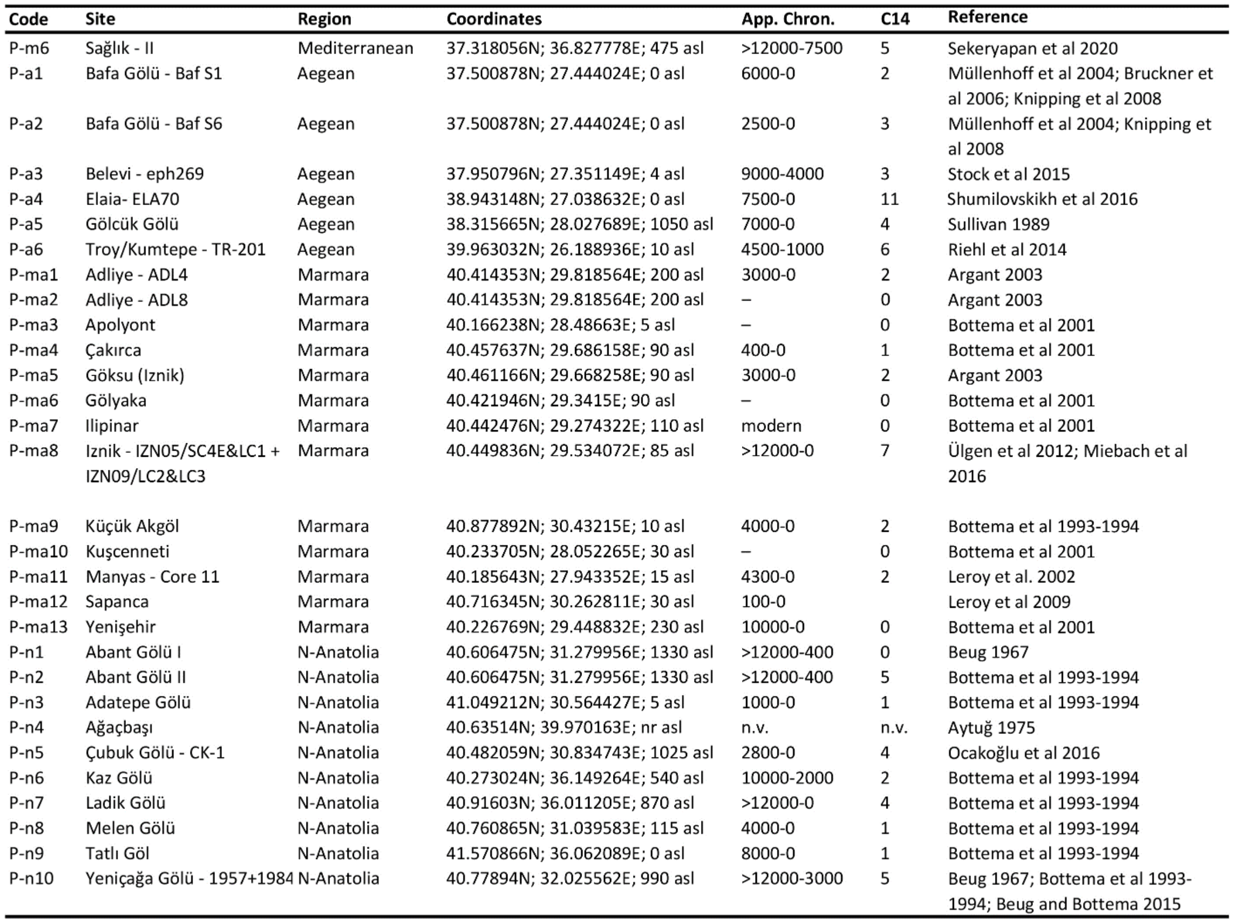
Zeist and colleagues (van Zeist et al. 1970) published two pollen sequences from southeastern Turkey (Gölbasi and Bozova); van Zeist et al. (1975) published several pollen records from the southwestern Anatolian region, the so-called Lake District (Karamik Bataklığı, Beyşehir, Hoyran Gölü, Söğüt Gölü, and Köyceğiz Gölü) (Section 1.1.2); additional pollen records from the same region were published by Bottema and Woldring (1984) (Beyşehir II, Akgöl-Adabağ, Gölhisar Gölü, Pinarbaşı, Elmali, Avlan Gölü, and Ova Gölü); Bottema et al. (1993-1994), furthermore, published several sequences from northern Anatolia (Abant Gölü, Yeniçağa Gölü, Melen Gölü, Küçük Akgöl, Adatepe, Seyfe Gölü, Tuzla Gölü, Demiryurt Gölü, Büyük Gölü, Kaz Gölü, Ladik Gölü, and Tatlı Gölü), and (Bottema et al. 2001) from the Marmara region (Yenişehir, Apolyon Gölü, Gölyaka, Kuşcenneti, and Çakırca, Ilipinar). In addition to these regional studies, the Groningen group published pollen records from the Van Lake (Van Zeist and Woldring 1978, Bottema 1995) and Eski Acıgöl (Woldring and Bottema 2002).

In more recent scholarship, research conducted by palynologists from the University of Leuven, working within the general framework of the Sagalassos regional project, provided high-resolution and well-dated pollen sequences from southwestern Anatolia: Ağlasun (Vermoere 2004, Bakker et al 2012), Bereket (Kaniewski et al 2007a, 2007b), and Gravgaz (Vermoere et al 2000, 2002, Bakker et al 2011, 2012). British scholars published pollen and paleoenvironmental evidence from Çatalhöyük (Eastwood et al. 2007, 2018), Çöl Gölü (Roberts et al 2009), Eski Acıgöl (Roberts et al 2001), Nar Gölü (England et al. 2008, Roberts et al. 2016), and Gölhisar Gölü (Eastwood et al 1998, 2002, 2007).

(Next page) Figure 2.10 – *Published Holocene palynological sequences, by region (see Chapter 1). Site codes correspond to Table 2.9. Ecological regions are delineated after Atalay 2014. Central Anatolia is marked in red.*


Palynological Records
🟨 Aegean
🟥 C-Anatolia
🟪 E-Anatolia
🟩 Tr-Marmara
🟦 Mediterranean
🟩 Black Sea
🟫 SE-Anatolia
🟦 Tr-Mediterranean
0 62.5 125 250 375 500 Kilometers
P-e1
P-e2
P-e3
P-e8-11
P-e7
P-e4
P-e5
P-e6
P-se1
P-n4
P-m2
P-m6
Büyük Göl Demiryurt
P-n6
P-n9
P-n7
Tuzla
Engir
Sultansazlığı
Mucur O.
Seyfe Gölü
Bor
Çöl Gölü
Eski Acıgöl
Nar Gölü
Akgöl-Adabağ
P-m1
Tuz Gölü
Çatalhöyük
Mogan
P-n10
P-n1
P-n2
P-n8
P-n5
P-n3
P-ma9
P-ma4-5
P-ma1-2
P-ma13
P-ma8
P-ma7
P-ma6
P-ma3
P-ma11
P-ma10
Karamik Bataklığı
P-tm6
P-tm7
P-tm15
P-tm3
P-tm12-14
P-m4
P-tm4
P-tm8
P-tm5
P-tm17
P-tm18
P-tm16
P-tm 9-11
P-m5
P-m3
P-a5
P-a3
P-a1
P-a2
P-a4
P-a6

Code	Site	Region	Coordinates	App. Chron.	C14	Reference
P-c1	Akgöl-Adabağ	C-Anatolia	37.52778N; 33.789669E; 1000 asl	>12000-4000	3	Bottema and Woldring 1984
P-c2	Bor - L2	C-Anatolia	37.85835N; 34.553147E; 1095 asl	10000-6000	2	Bayer Altın et al 2021
P-c3	Büyük Göl	C-Anatolia	39.871043N; 37.378343E; 1290 asl	–	0	Bottema et al 1993-1994
P-c4	Çatalhöyük-CH95F	C-Anatolia	37.666311N; 32.825722E; 1010 asl	8000-7000	1	Eastwood et al 2007
P-c5	Çatalhöyük-CH99 H/J	C-Anatolia	37.666311N; 32.825722E; 1010 asl	8000-7500	8	Eastwood et al 2018
P-c6	Çöl Gölü	C-Anatolia	40.59072N; 33.680092E; 870 asl	2000-0	2	Roberts et al 2009
P-c7	Demiryurt Gölü	C-Anatolia	39.888053N; 37.579011E; 1300 asl	2000-0	1	Bottema et al 1993-1994
P-c8	Engir - EG 15-03	C-Anatolia	38.80252N; 35.591001E; 1080 asl	2300-0	2	Şenkul et al 2018b
P-c9	Eski Acıgöl-ESK92	C-Anatolia	38.550409N; 34.544295E; 1270 asl	11000-0	7	Roberts et al 2001; Woldring and Bottema 2002
P-c10	Karamik Bataklığı	C-Anatolia	38.442101N; 30.804689E; 1000 asl	>12000-8000	2	van Zeist et al. 1985
P-c11	Mogan - MD	C-Anatolia	39.763339N; 32.794344E; 975 asl	600-0	2	Oybak Dönmez et al 2021
P-c12	Mogan - MS	C-Anatolia	39.763339N; 32.794344E; 975 asl	3000-0	3	Oybak Dönmez et al 2021
P-c13	Mucur Obruk - MOG 14-01	C-Anatolia	39.061932N; 34.518898E; 1175 asl	800-100	2	Şenkul and Doğan 2018
P-c14	Nar Gölü - NAR01/02	C-Anatolia	38.339966N; 34.456505E; 1370 asl	1700-0	(varve)	England et al 2008
P-c15	Nar Gölü - NAR10	C-Anatolia	38.339966N; 34.456505E; 1370 asl	>12000-0	(U–Th)	Roberts et al 2016
P-c16	Seyfe Gölü	C-Anatolia	39.227498N; 34.376528E; 1110 asl	–	0	Bottema and Woldring 1984
P-c17	Sultansazlığı - core A+B	C-Anatolia	38.260776N; 35.210374E; 1070 asl	>12000-0	6	Şenkul et al 2022
P-c18	Tuz Gölü	C-Anatolia	38.757882N; 33.339929E; 905 asl	n.v.	n.v.	Inceoğlu and Pehlivanli 1987
P-c19	Tuzla	C-Anatolia	39.022848N; 35.813193E; 1130 asl	–	0	Bottema et al 1993-1994
P-c20	Tuzla - TZL	C-Anatolia	39.022848N; 35.813193E; 1130 asl	5000-0	2	Şenkul et al 2018a
P-e1	Aktas - AC1	E-Anatolia	41.193999N; 43.178584E; 1800 asl	1000-0	3	Karlıoglu Kılıç et al 2018
P-e2	Aktas - AC2	E-Anatolia	41.193999N; 43.178584E; 1800 asl	700-0	3	Karlıoglu Kılıç and Ersin 2019
P-e3	Arin - A3	E-Anatolia	38.814534N; 42.992219E; 1655 asl	–	0	Kamar 2018
P-e4	Bulemaç - T1-4	E-Anatolia	39.979132N; 41.560771E; 1730 asl	>12000-0	4	Collins et al 2005
P-e5	Hazar Gölü I	E-Anatolia	38.516667N; 39.416666E; 1240 asl	13000-0	6	Biltekin et al 2018
P-e6	Hazar Gölü II	E-Anatolia	38.516667N; 39.416666E; 1240 asl	3000-500	3	Biltekin et al 2021
P-e7	Söğütlü	E-Anatolia	38.67088N; 41.962703E; 1280 asl	8000-0	3	Bottema 1995
P-e9	Van - 2+13	E-Anatolia	38.621917N; 42.594841E; 1645 asl	10000-0	(varve)	van Zeist and Woldring 1978
P-e10	Van - 90.4	E-Anatolia	38.621917N; 42.594841E; 1645 asl	>12000-0	(varve)	Wick et al 2003
P-e11	Van - ICDP core	E-Anatolia	38.621917N; 42.594841E; 1645 asl	>12000-0	(other)	Litt et al 2014
P-se1	Bozova	SE-Anatolia	37.403611N; 38.535054E; 570 asl	2500-0	1	van Zeist et al 1970
P-tm1	Ağlasun - 12	Tr-Mediter.	37.664341N; 30.520058E; 1230 asl	7500-0	5	Vermoere 2004; Bakker et al 2012
P-tm2	Ağlasun - 13	Tr-Mediter.	37.664341N; 30.520058E; 1230 asl	8000-0	2	Vermoere 2004; Bakker et al 2012
P-tm3	Ağlasun - 6	Tr-Mediter.	37.664341N; 30.520058E; 1230 asl	9000-0	4	Vermoere 2004; Bakker et al 2012
P-tm4	Avlan Gölü	Tr-Mediter.	36.592511N; 29.954699E; 1030 asl	–	0	Bottema and Woldring 1984
P-tm5	Bereket - BKT1+BKT2	Tr-Mediter.	37.548722N; 30.282261E; 1460 asl	3500-0	11	Kaniewski et al 2007a; Kaniewski et al 2007b
P-tm6	Beyşehir I	Tr-Mediter.	37.770601N; 31.513018E; 1125 asl	6000-0	2	van Zeist et al. 1975
P-tm7	Beyşehir II	Tr-Mediter.	37.770601N; 31.513018E; 1125 asl	>12000-0	1	Bottema and Woldring 1984
P-tm8	Elmalı Gölü	Tr-Mediter.	36.580259N; 29.952825E; 1025 asl	–	0	Bottema and Woldring 1984
P-tm9	Gölhisar Gölü	Tr-Mediter.	37.119211N; 29.592657E; 945 asl	9000-0	0	Bottema and Woldring 1984
P-tm10	Gölhisar Gölü - GHA	Tr-Mediter.	37.119211N; 29.592657E; 945 asl	10000-0	12	Eastwood et al 1998; Eastwood et al 2007
P-tm11	Gölhisar Gölü - GHE	Tr-Mediter.	37.119211N; 29.592657E; 945 asl	3500-3000	(tefra)	Eastwood et al 2002
P-tm12	Gravgaz - 06 SA06EPB1	Tr-Mediter.	37.577961N; 30.401167E; 1235 asl	2500-0	7	Bakker et al 2011; Bakker et al 2012
P-tm13	Gravgaz - 96	Tr-Mediter.	37.577961N; 30.401167E; 1235 asl	3000-0	4	Vermoere et al 2000; Vermoere et al 2002; Bakker et al 2012
P-tm14	Gravgaz - 99	Tr-Mediter.	37.577961N; 30.401167E; 1235 asl	2500-0	6	Vermoere et al 2002; Bakker et al 2012
P-tm15	Hoyran Gölü	Tr-Mediter.	38.200146N; 30.813001E; 920 asl	6000-0	1	van Zeist et al. 1975
P-tm16	Işıklı Gölü	Tr-Mediter.	38.234972N; 29.897038E; 815 asl	n.v.	n.v.	Gemici 1986
P-tm17	Pinarbaşı	Tr-Mediter.	37.451929N; 30.056533E; 985 asl	>12000-0	2	Bottema and Woldring 1984
P-tm18	Söğüt Gölü	Tr-Mediter.	37.077542N; 29.881559E; 1400 asl	>12000-0	2	van Zeist et al 1975
P-m1	Elaiussa Sebaste - ELA6	Mediterranean	36.483624N; 34.173725E; 20 asl	1900-0	4	Melis et al 2015
P-m2	Gölbaşı-Bozova	Mediterranean	37.799819N; 37.646805E; 880 asl	3000-0	1	van Zeist et al 1970
P-m3	Köyceğiz Gölü	Mediterranean	36.873034N; 28.631389E; 0 asl	5000-0	2	van Zeist et al 1975
P-m4	Öküzini	Mediterranean	36.952398N; 30.534594E; 280 asl	>12000-9000	3	Emery-Barbier and Thiébault 2005
P-m5	Ova Gölü	Mediterranean	36.323594N; 29.362788E; 2 asl	6500-0	2	Bottema and Woldring 1984



Code	Site	Region	Coordinates	App. Chron.	C14	Reference
P-m6	Sağlık - II	Mediterranean	37.318056N; 36.827778E; 475 asl	>12000-7500	5	Sekeryapan et al 2020
P-a1	Bafa Gölü - Baf S1	Aegean	37.500878N; 27.444024E; 0 asl	6000-0	2	Müllenhoff et al 2004; Bruckner et al 2006; Knipping et al 2008
P-a2	Bafa Gölü - Baf S6	Aegean	37.500878N; 27.444024E; 0 asl	2500-0	3	Müllenhoff et al 2004; Knipping et al 2008
P-a3	Belevi - eph269	Aegean	37.950796N; 27.351149E; 4 asl	9000-4000	3	Stock et al 2015
P-a4	Elaia- ELA70	Aegean	38.943148N; 27.038632E; 0 asl	7500-0	11	Shumilovskikh et al 2016
P-a5	Gölcük Gölü	Aegean	38.315665N; 28.027689E; 1050 asl	7000-0	4	Sullivan 1989
P-a6	Troy/Kumtepe - TR-201	Aegean	39.963032N; 26.188936E; 10 asl	4500-1000	6	Riehl et al 2014
P-ma1	Adliye - ADL4	Marmara	40.414353N; 29.818564E; 200 asl	3000-0	2	Argant 2003
P-ma2	Adliye - ADL8	Marmara	40.414353N; 29.818564E; 200 asl	–	0	Argant 2003
P-ma3	Apolyont	Marmara	40.166238N; 28.48663E; 5 asl	–	0	Bottema et al 2001
P-ma4	Çakırca	Marmara	40.457637N; 29.686158E; 90 asl	400-0	1	Bottema et al 2001
P-ma5	Göksu (Iznik)	Marmara	40.461166N; 29.668258E; 90 asl	3000-0	2	Argant 2003
P-ma6	Gölyaka	Marmara	40.421946N; 29.3415E; 90 asl	–	0	Bottema et al 2001
P-ma7	Ilipinar	Marmara	40.442476N; 29.274322E; 110 asl	modern	0	Bottema et al 2001
P-ma8	Iznik - IZN05/SC4E&LC1 + IZN09/LC2&LC3	Marmara	40.449836N; 29.534072E; 85 asl	>12000-0	7	Ülgen et al 2012; Miebach et al 2016
P-ma9	Küçük Akgöl	Marmara	40.877892N; 30.43215E; 10 asl	4000-0	2	Bottema et al 1993-1994
P-ma10	Kuşcenneti	Marmara	40.233705N; 28.052265E; 30 asl	–	0	Bottema et al 2001
P-ma11	Manyas - Core 11	Marmara	40.185643N; 27.943352E; 15 asl	4300-0	2	Leroy et al. 2002
P-ma12	Sapanca	Marmara	40.716345N; 30.262811E; 30 asl	100-0		Leroy et al 2009
P-ma13	Yenişehir	Marmara	40.226769N; 29.448832E; 230 asl	10000-0	0	Bottema et al 2001
P-n1	Abant Gölü I	N-Anatolia	40.606475N; 31.279956E; 1330 asl	>12000-400	0	Beug 1967
P-n2	Abant Gölü II	N-Anatolia	40.606475N; 31.279956E; 1330 asl	>12000-400	5	Bottema et al 1993-1994
P-n3	Adatepe Gölü	N-Anatolia	41.049212N; 30.564427E; 5 asl	1000-0	1	Bottema et al 1993-1994
P-n4	Ağaçbaşı	N-Anatolia	40.63514N; 39.970163E; nr asl	n.v.	n.v.	Aytuğ 1975
P-n5	Çubuk Gölü - CK-1	N-Anatolia	40.482059N; 30.834743E; 1025 asl	2800-0	4	Ocakoğlu et al 2016
P-n6	Kaz Gölü	N-Anatolia	40.273024N; 36.149264E; 540 asl	10000-2000	2	Bottema et al 1993-1994
P-n7	Ladik Gölü	N-Anatolia	40.91603N; 36.011205E; 870 asl	>12000-0	4	Bottema et al 1993-1994
P-n8	Melen Gölü	N-Anatolia	40.760865N; 31.039583E; 115 asl	4000-0	1	Bottema et al 1993-1994
P-n9	Tatlı Göl	N-Anatolia	41.570866N; 36.062089E; 0 asl	8000-0	1	Bottema et al 1993-1994
P-n10	Yeniçağa Gölü - 1957+1984	N-Anatolia	40.77894N; 32.025562E; 990 asl	>12000-3000	5	Beug 1967; Bottema et al 1993-1994; Beug and Bottema 2015

Table 2.9 – *Holocene palynological sequences from Anatolia (modern Turkey) covering the Holocene period. Regions are defined and discussed in* Chapter 1*. Coordinates are in WGS84, decimal degree. The chronological extension of the sequences (in years from present, BP) originate from the literature, and it should be regarded as approximative.*

Finally, I will note that, over the past decade, a marked increase in records published by Turkish scholars has led to publication of pollen sequences from Engir Lake (Şenkul et al 2018b), Mogan Lake (Oybak Dönmez et al 2021), Mocur Obruk (Şenkul and Doğan 2018), Sultansazlığı (Şenkul et al 2022), Tuzla (Şenkul et al 2018a), Aktas (Karlıoglu Kılıç et al 2018, Karlıoglu Kılıç and Ersin 2019), Arin Lake (Kamar 2018), Hazar Gölü (Biltekin et al 2018 and 2021), Sağlık (Sekeryapan et al 2020), Iznik Gölü (Ülgen et al 2012), and Çubuk Gölü (Ocakoğlu et al 2016).

Before moving to a more detailed discussion of the evidence available for the Late Holocene (i.e., intersecting with the time period covered by the dissertation project), some general considerations concerning some intrinsic issues in the Anatolian fossil pollen record are to be made.

(*i*) Chronology is often problematic, and as such it requires to be critically evaluated on a case-by-case basis. Several sequences, especially from the early scholarship, are with few (or none) radiocarbon dates. It is, furthermore, to be noted the common practice of dating bulk samples of organic debris, often due to the lack of suitable terrestrial plant macrofossils, which could result in errors associated to radiocarbon reservoir effect (Grimm et al. 2009). In lakes located in volcanic contexts, such as in Cappadocia (e.g., Eski Acigöl), radiocarbon determinations can be furthermore impacted by volcanic out-gassing, which can cause an incorporation of old carbon (Roberts et al, 2001: 725).

(*ii*) the long-distance atmospheric transportation of pollen grains is a second critical aspect to be consider in the evaluation of palynological records from Asia Minor, especially from central Anatolia. The latter is a high plateau surrounded by forested mountain chains, in which pine is one of the dominant arboreal components (Chapter 1). *Pinus* is a prolific pollen producer, which pollen is dispersed over long distances (e.g., Szczepanek et al. 2017). The latter aspect is favored by the inflated structures ('sacci') on the pollen grains, which support long-distance atmospheric transport. As noted by studying modern pollen rain (e.g., Woldring and Bottema 2002: 11), the contribution of pine to the local vegetation is problematic for vegetation reconstruction, given the difficulties in distinguishing local, regional, and supra-regional signals. Similar problems are associated with the interpretation of olive pollen, because *Olea* is a further main pollen producer, with grains that are dispersed over large distances (Kaniewski et al. 2009). The possible presence (and extension) of olive orcharding in central Anatolia is at the center of a long-standing debate in the palynological literature (England et al. 2021, and references therein).

(*iii*) finally, terminal lakes and wetlands in central Anatolia are subject to cyclical episodes of desiccation, which are associated with erosion (e.g., Bottema and Woldring 1984). The resulting hiatus in the sedimentary sequences are a challenge to the elaboration of accurate age-depth models.

- *Late Holocene pollen sequences from central Anatolia*

Despite the limits outlined in the previous section, pollen evidence provides crucial information about Anatolian vegetation history and on the development of the regional agricultural landscape. Of particular importance, as I will discussed at length in Part III of dissertation, is the so-called 'Beyşehir Occupation Phase', a well-defined Late Holocene regional palynological phase of deforestation, agricultural expansion, and arboriculture (van Zeist et al. 1975, Bottema et al. 1986, 1990, Eastwood et al. 1998, Roberts 2018, Woodbridge et al. 2019). In Table 2.10 and Figure 2.11 I have reported the palynological sequences covering the period from ca. 3000 to 1 BCE. Only the sequences having at least one radiocarbon determination (or another independent chronological date; e.g., varve count, tephra) are considered. Radiocarbon determinations having a laboratory error greater than ±100 years are disregarded.

Five chronological sequences from central Anatolia meet the aforementioned criteria: lake Tuzla (Inceoğlu and Pehlivanli 1987), Mogan Gölü (Oybak Dönmez et al 2021), Nar Gölü (England et al.

2018, Roberts et al 2016), Eski Acıgöl (Roberts et al 2001, Woldring and Bottema 2002), and Sultansazlığı (Şenkul et al 2022).

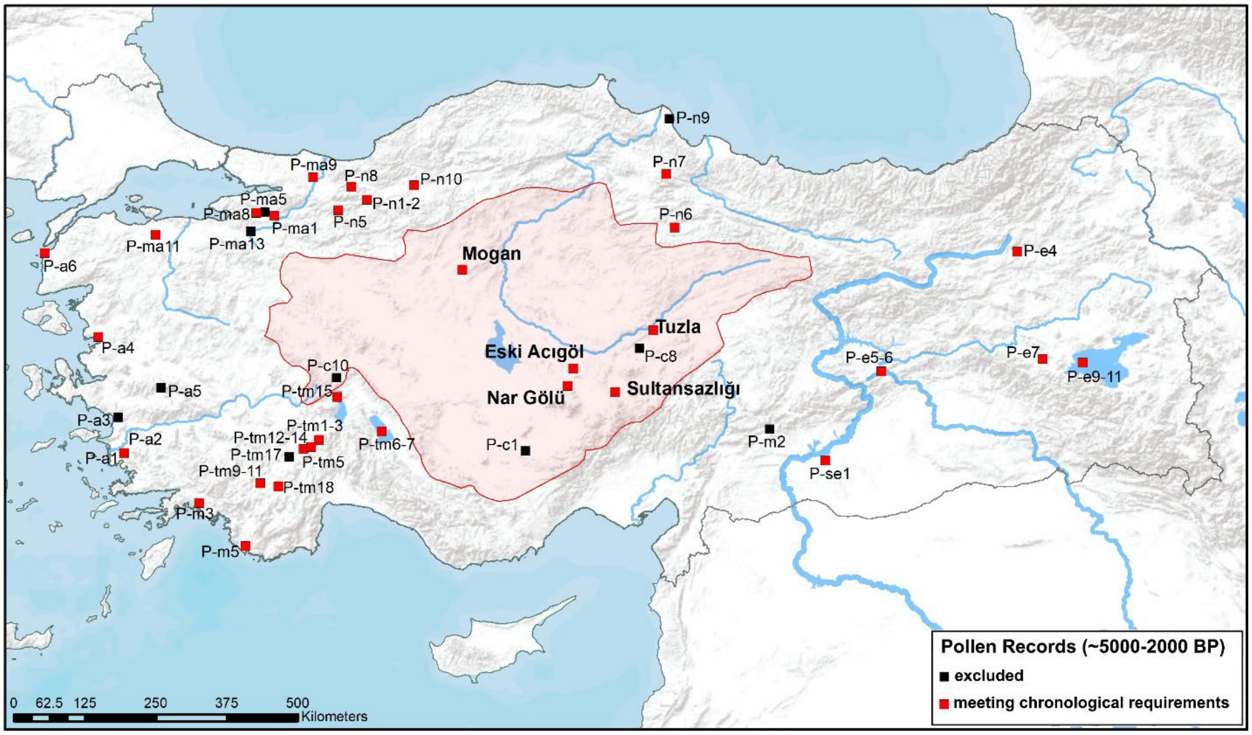

P-n9
P-n7
P-ma9
P-n8
P-n10
P-ma5
P-n1-2
P-ma8
P-ma1
P-n5
P-n6
P-ma11
P-ma13
P-a6
Mogan
P-e4
Tuzla
P-c8
P-a4
Eski Acıgöl
P-e5-6
P-e7
P-e9-11
P-c10
P-a5
P-tm15
Nar Gölü
Sultansazlığı
P-a3
P-tm1-3
P-m2
P-a2
P-tm12-14
P-tm6-7
P-c1
P-a1
P-tm17
P-tm5
P-se1
P-tm9-11
P-tm18
P-m3
P-m5
Pollen Records (~5000-2000 BP)
■ excluded
■ meeting chronological requirements
0 62.5 125 250 375 500
Kilometers

Figure 2.11 – *Published palynological sequences, covering the period 3000-1 BCE and with at least one radiocarbon determination for the chronological period of interest. Radiocarbon determinations having a laboratory error greater than ±100 years are not considered. Site codes correspond to* Table 2.10. *Central Anatolia is marked in red.*

In the Euphrates, a Late Holocene pollen sequence is available from Bozova (van Zeist et al. 1970), while in the Tigris Valley pollen data are published from Hazar Gölü (Biltekin et al 2018, 2021). In eastern Anatolia, dated sequences covering the period from 3000 to 1 BCE originate from Söğütlü (Bottema 1995), Van (Wick et al 2003), and Bulemaç (Collins et al. 2005). The Lake District of southwestern Anatolia is characterized by a wealth of data on Late Holocene vegetation, with dated pollen sequences from Ağlasun (Vermoere 2004, Bakker et al 2012), Bereket (Kaniewski et al 2007a, 2007b), Beyşehir I (van Zeist et al. 1975), Gölhisar Gölü (Eastwood et al 1998, 2002, 2007), Gravgaz

(Vermoere et al 2000, 2002, Bakker et al 2012), Hoyran Gölü (van Zeist et al. 1975), and Söğüt Gölü (van Zeist et al. 1975).

Code	Site	Region	C14	Reference
P-a1	Bafa Gölü - Baf S1	Aegean	2819±38 (marine sheel); 3294±38 (marine sheel)	Müllenhoff et al 2004; Bruckner et al 2006; Knipping et al 2008
P-a2	Bafa Gölü - Baf S6	Aegean	2681±38 (marine sheel)	Müllenhoff et al 2004; Knipping et al 2008
P-a4	Elaia- ELA70	Aegean	1960±30 (charcoal); 2253±42 (pollen); 2680±30 (seaweed); 2659±31 (seed); 4274±31 (seaweed)	Shumilovskikh et al 2016
P-a6	Troy/Kumtepe - TR-201	Aegean	2355±35 (nr); 2495±35 (nr); 3835±19 (nr); 4635±35 (nr); 4619±20 (nr)	Riehl et al 2014
P-c9	Eski Acıgöl-ESK92	C-Anatolia	(other)	Roberts et al 2001; Woldring and Bottema 2002
P-c12	Mogan - MS	C-Anatolia	2500±25 (charcoal)	Oybak Dönmez et al 2021
P-c15	Nar Gölü - NAR10	C-Anatolia	(other)	Roberts et al 2016
P-c17	Sultansazlığı - core A+B	C-Anatolia	2666±28 (bulk); 4043±31 (bulk)	Şenkul et al 2022
P-c20	Tuzla - TZL	C-Anatolia	3080±30 (bulk)	Şenkul et al 2018a
P-e4	Bulemaç - T1-4	E-Anatolia	3680±40 (bulk); 4860±60 (bulk)	Collins et al 2005
P-e5	Hazar Gölü I	E-Anatolia	2240±45 (mollusc); 3560±45 (wood)	Biltekin et al 2018
P-e6	Hazar Gölü II	E-Anatolia	2420±30 (plant); 3420±35 (plant)	Biltekin et al 2021
P-e7	Söğütlü	E-Anatolia	2810±60 (nr)	Bottema 1995
P-e9	Van - 2+13	E-Anatolia	(other)	van Zeist and Woldring 1978
P-e10	Van - 90.4	E-Anatolia	(other)	Wick et al 2003
P-e11	Van - ICDP core	E-Anatolia	(other)	Litt et al 2014
P-ma1	Adliye - ADL4	Marmara	2190±60 (bulk); 2615±55 (bulk)	Argant 2003
P-ma8	Iznik - IZN05/SC4E&LC1 + IZN09/LC2&LC3	Marmara	2880±100 (plant); 3510±240 (plant); 4720±30 (bulk); (other)	Ülgen et al 2012; Miebach et al 2016
P-ma9	Küçük Akgöl	Marmara	2020±60 (nr); 2600±80 (nr)	Bottema et al 1993-1994
P-ma11	Manyas - Core 11	Marmara	3750±40 (twig)	Leroy et al. 2002
P-m3	Köyceğiz Gölü	Mediterranean	3070±45 (bulk)	van Zeist et al 1975
P-m5	Ova Gölü	Mediterranean	2150±100	Bottema and Woldring 1984
P-n2	Abant Gölü II	N-Anatolia	2920±60 (nr); 3880±60 (nr)	Bottema et al 1993-1994
P-n5	Çubuk Gölü - CK-1	N-Anatolia	2190±25 (charcoal)	Ocakoğlu et al 2016
P-n6	Kaz Gölü	N-Anatolia	2220±90 (nr)	Bottema et al 1993-1994
P-n7	Ladik Gölü	N-Anatolia	2760±50 (nr); 4280±80 (nr)	Bottema et al 1993-1994
P-n8	Melen Gölü	N-Anatolia	2840±100	Bottema et al 1993-1994
P-n10	Yeniçağa Gölü - 1957+1984	N-Anatolia	3980±90 (bulk); 4330±160 (bulk)	Beug 1967; Bottema et al 1993-1994; Beug and Bottema 2015
P-se1	Bozova	SE-Anatolia	2590±70 (nr)	van Zeist et al 1970
P-tm3	Ağlasun - 6	Tr-Mediterranean	1 date (n.v.)	Vermoere 2004; Bakker et al 2012
P-tm5	Bereket - BKT1+BKT2	Tr-Mediterranean	1970±40 (bulk); 2140±40 (wood); 2370±40 (wood)	Kaniewski et al 2007a; Kaniewski et al 2007b
P-tm6	Beyşehir I	Tr-Mediterranean	3265±35 (bulk)	van Zeist et al. 1975
P-tm10	Gölhisar Gölü - GHA	Tr-Mediterranean	2480±55 (bulk); 2830±50 (bulk); 3330±70 (bulk); 4900±50 (bulk); (other)	Eastwood et al 1998; Eastwood et al 2007
P-tm11	Gölhisar Gölü - GHE	Tr-Mediterranean	(other)	Eastwood et al 2002
P-tm13	Gravgaz - 96	Tr-Mediterranean	2495±40 (nr); 2480±120 (nr)	Vermoere et al 2000; Vermoere et al 2002; Bakker et al 2012
P-tm14	Gravgaz - 99	Tr-Mediterranean	2220±50 (bulk); 2270±50 (bulk); 2400±45 (plants); 2520±40 (plants)	Vermoere et al 2002; Bakker et al 2012
P-tm15	Hoyran Gölü	Tr-Mediterranean	2470±50 (bulk)	van Zeist et al. 1975
P-tm18	Söğüt Gölü	Tr-Mediterranean	2885±35 (bulk)	van Zeist et al 1975

Table 2.10 – *Late Holocene palynological sequences from Anatolia (modern Turkey) covering the period from ~3000 to 1 BCE. Regions are defined and discussed in Chapter 1. Coordinates are in WGS84, decimal degree. Only records with at least one 14C date in the period 3000-1 BCE are included, without considering dates with error greater than ±100 years. Radiocarbon dates are uncalibrated (year BP).*

On the Mediterranean coast, pollen sequences covering the period between 3000-1 BCE are published from Köyceğiz Gölü (van Zeist et al. 1975) and Ova Gölü (Bottema and Woldring 1984).

Further to the north, on the Aegean coast, contemporaneous pollen sequences are available from Bafa Gölü (near Ephesos; Müllenhoff et al 2004, Bruckner et al 2006, Knipping et al 2008), Elaia (near Pergamon; Shumilovskikh et al 2016), and in the environ of Troy (Riehl et al. 2014). In this review are, furthermore, to be included Adliye (Argant 2003), Iznik (Ülgen et al 2012, Miebach et al 2016), Küçük Akgöl (Bottema et al 1993-1994), Manyas (Leroy et al. 2002), and data from the Marmara region. Finally, in northern Anatolia, sequences meeting the selected criteria originate from Abant Gölü (Bottema et al 1993-1994), Çubuk Gölü (Ocakoğlu et al 2016), Kaz Gölü (Bottema et al 1993-1994), Ladik Gölü (Bottema et al 1993-1994), Melen Gölü (Bottema et al 1993-1994), and Yeniçağa Gölü (Beug 1967, Bottema et al 1993-1994, Beug and Bottema 2015).

2.3 Textual sources

Having introduced to the available archaeobotanical and palynological evidence, in this section, I will provide an overview of the available textual sources. This survey will be laid out in chronological order, by presenting and discussing the available documentary evidence on agriculture from the earliest written documents available from central Anatolia (Middle Bronze Age, 2000-1600 BCE; Section 2.3.1) to the latest period covered by this dissertation project (Hellenistic, 330-1 BCE; Section 2.3.4). The main aim of this section is to provide a general and concise presentation of the available textual sources, which are considered of relevance for the scope of the project. I will further expand on several topics introduced in this section in Part III of the dissertation. For an introduction to the broader historical and archaeological context, I refer the reader to Section 1.2.

The mapping of ancient phytonyms onto modern (either common or scientific) classificatory systems is an intrinsically problematic endeavor. Ancient plant nomenclature is to be understood as part of a broader and localized folk taxonomic system, which by definition is embedded in its specific cultural milieu (e.g., Berlin 1992). In early philological scholarship, confidence in etymology promoted a widespread attempt to directly translate most of the phytonyms recorded in western Asian cuneiform sources, a trend which is best exemplified by the *Chicago Assyrian Dictionary*. As a result of this overconfidence, quoting from Marvin A. Powell, "*The literature is filled with contradictions and guesses that range from educated to unfounded*" (2003-2005: 14). A more prudent approach is currently dominant in the scholarship, by acknowledging that "*It seem fairly clear that most species of plants mentioned in cuneiform texts will never be identified with certainty, but precision in terminology and attention to the natural distribution and history of flora do permit at least an encouraging residue of probable identifications that may be increased in the future as new evidence accumulates*" (Powell 2003-2005: 14).

A further layer of challenges is specifically connected to the Anatolian cuneiform writing cultures. The Old Assyrian script and language recorded in archives from the Middle Bronze Age Assyrian trading centers (Sections 1.2.2 and 2.3.1) reflects an adaptation of cuneiform writing to the purposes of private merchants, whose education was outside the traditional Near Eastern scribal curriculum (e.g., Larsen 2015). Both the reading and translation of these tablets have proven to be challenging. In the following Late Bronze Age (Sections 1.2.3 and 2.3.2), Hittite cuneiform developed from the Syrian tradition. The Akkadograms and Sumerograms commonly used in Anatolian texts cannot be assumed to have maintain the same meaning associated to them in their original Mesopotamian context – in several instances the opposite has actually been proven to be true (e.g., Franz-Szabo 2003-2005, Weeden 2011).

In addition to terminological issues, a second order of problems is associated with the coverage of agricultural matters in documentary records. Broadly speaking, the ancient western Asian cuneiform writing practice stemmed from an archival tradition. The praxis of agriculture, which is rooted in the long-durée of the rural life, often falls outside the scopes of such a writing tradition (e.g., Marazzi 2008: 64). In other words, we do not have anything comparable to the agronomic genre attested elsewhere – e.g., in the Greco-Roman agricultural literary tradition, well exemplified by authors such as Cato (*De Agricultura*), Columella (*De Re Rustica*), Varro (*Rerum Rusticarum*), and Palladius (*Opus Agriculturae*). The bureaucratic structure and functioning of economies in the Mesopotamian alluvium are associated with a tradition of bookkeeping, which, nevertheless, provides important insights on administrative aspect of agricultural production and extraction, staples accumulation, and resources redistribution (e.g., Hudson and Wunsch 2004). Anatolian archives are in these regards an outlier in western Asia contexts: for the entire chronological period (ca. 3000-1 BCE) discussed in this dissertation, a local tradition of bookkeeping is not attested. In the specific context of Hittite Anatolia, the lack of administrative documentation (with the sole exception being single tables from the archive of Maşat Höyük, del Monte 1995) has been reconducted to a possible use for such task of medium other than clay tables, such was likely the case of waxed wooden tablets (e.g., Marazzi 2007, Cammarosano et al. 2019), or to the presence of an (illiterate) local administrative practice (d'Alfonso and Matessi 2021).

A further, more general, consideration is to be made. Without slipping into too simplistic of generalizations, it is unclear how representative the documentary record of the broader socio-cultural and economic landscape is. In this dissertation, I will assume that these sources are expressing and reflecting a domain that approximates the whole socio-cultural system. Yet, this remains a central question in historiography.

2.3.1 *Middle Bronze Age: agriculture in the textual sources from the Anatolian Assyrian colonies*

The earliest known written sources from central Anatolia originate from the Old Assyrian trading centers. As I have already discussed in Section 1.2.2, the overwhelming majority of the documentary evidence dated to this period has been discovered at Kültepe, a site located a few kilometers northeast of the modern city of Kayseri and identified with the central Anatolian city-state of *Kaneš*/*Neša* (Larsen 2015, and references therein). The lower town of Kültepe hosted an Old Assyrian training colony (*kārum*), which was part of a broader network of trading centers.

More than 22,500 Old Assyrian tablets have been underneath at Kültepe, included in this total are both looted and excavated materials (Barjamovic 2011: 55). The textual record from Kültepe has been of central importance in the study of economic history, providing a unique view on trades and markets in the pre-Classical periods (Michel 2005, and references therein) (Section 1.2.2). In light of the nature of this evidence, Old Assyrian scholarship has been overwhelmingly focused on topics of trade and economic history, with very little attention given to agriculture and subsistence. As a result, there is currently a lack of detailed studies of the evidence concerning agriculture at *Kaneš*. Two important contributions on the topic, although brief and based on a selection of sources, have been published by Dercksen (2008a, 2008b).

- *Barley and wheat at* Kaneš*: terminology, cultivation, markets*

In the texts from *Kaneš*, five terms are understood to indicate cereals: three Akkadian words (*še'um*, *aršātum*, *uṭṭutum*) and two Sumerograms (GIG, ŠE) (Hoffner 1974: 59, Michel 1997: 99, Dercksen 2008a: 144). In Mesopotamian proper, the logograms GIG and ŠE respectively indicate wheat and barley. Based on the co-occurrence of the logographic and syllabic spelling, ŠE is equated to *še'um* and GIG to *aršātum* (Michel 1997: 99). The translation of ŠE=*še'um* as "barley" is accepted in the literature (Michel 1997: 99), and as such it does not require in this context any further discussion (see CAD, Š-II: 345-1a for further information). More problematic, on the other hand, has been the translation of *aršātum*, an Akkadian term that is to date attested only at *Kaneš* (Michel 1997: 99). On a semantic basis (*aršātum* pl. fem of the adjective *aršu*="dirty"), Lewy (1956) proposed to translate this term as "dirty" grain, which is further speculatively attributed to a variety of black barley – according to Lewi (sic) *Hordeum vulgare nigrum/Hordeum distichum nigricans*. Rather than deriving from the adjective *aršu*, it has been proposed more recently that linguistically *aršātum* stem, more reasonably, from the verb *a/erāšum*="to cultivate" (Dercksen 2008a: 144). Having disregarded Lewy's transition, it is now considered more likely a translation of GIG=*aršātum* as "wheat" (Michel 1997: 99) (CAD, A-II: 309b). Finally, *uṭṭutum* is translated as a general term indicating cereal grains (Hoffner 1974: 59, Michel 1997: 99, Dercksen 2008a: 144). It should be noted the absence in the texts from *Kaneš* of the specific Akkadian term attested elsewhere referring to emmer wheat (*kunāšum*) (Dercksen 2008a: 144-145). The absence of the latter term is to be taken as highly significant, given the number of tablets included in the Old Assyrian record from *Kaneš*.

Land plots are indicated in texts from *Kaneš* using the general Akkadian word *eqlum* or the

Sumerogram GÁNA. In archival documents, the surface of cereal fields is expressed using the *naruqqum* (and its derivates), a unit measuring volumes: tentatively equated to ca. 120 liters (one "sack"). It is, thus, understood that it indicates the conventional surface of land that requires one sack (120 liters) of grain-seed (Derckers 2008a: 142). In concrete terms, the standard and the actual amount of sown grains often do not correspond: "2 fields, his share, of 2 *naruq* surface, (the debtor) will cultivate; the 6 jars of seeds are at his (expense)", according to this text, 180 liters of grains (1 jar = 30 liters) were used in order to sow a field that would have technically required 240 liters of seed-grains (Derckers 2008a: 142).

Textual evidence supports the presence of irrigation in the landscape surrounding *Kaneš*, which could have also included a portion of the arable land (Dercksen 2008a: 148-150). Of particular importance in these regards is a sale contract, which translates as follow:

> "Seal of Kupidahšu. Seal of ...dahšu, the chief [. . .] of the king. Seal of Kura. Seal of Halkiaššu. Seal of Dušala. Kupidahšu sold four field plots and a garden plot which are adjacent to his own field plots for 7 minas of silver to Ašuat. All the irrigation water that will flow will be for them both. If Kupidahšu breaks the contract he will pay 14 minas of silver to Ašuat. If Ašuat breaks the contract he (i.e., Kupidahšu) will take away the 7 minas of silver, the price of the garden and field plots, and (in addition Ašuat) will pay 7 minas of silver to Kupidahšu" (Dercksen 2008a: 149).

In a further text from *Kaneš* (TC 3) it is documented the occurrence of irrigation fees (*gamrun*), which in this specific case amounted to the considerable amount of half mina of silver:

> "1/2 mina of silver was spent on the fee for pouring water; 10 sheep cost 14 1/2 shekels of

> silver; we added 1 3/4 shekels of silver for the price of sheep of 'dividing' to the kārum office; we paid 1 ¾ shekels of silver for firewood. The remainder of your silver is 12 shekels of silver; out of which Ir'am-Ašur owes 5 ¼ shekels of silver. Spent on behalf of Ennānum" (Dercksen 2008a: 149).

The text does not specify the recipient of the fee, which according to Dercksen could be speculatively considered to have been the royal administration (Dercksen 2008a: 150). The involvement of the palace of *Kaneš* in irrigation work is further corroborated by the attestation of the title of "the head of the irrigated fields" (*rabi šaqiātim*).

At *Kaneš* the term used to indicate the plough was *epinnum*, which in Mesopotamia proper identifies the seeder-plough (Dercksen 2008a: 145-146). The Akkadian term *mayārum*, which is used elsewhere in order to indicate other types of ploughing implements, is not attested at *Kaneš* (Dercksen 2008a: 145-146). Potts (1997: 78-82; and references therein) provided a discussion of this technology in the Mesopotamian context. Following Halstead (1990: 187), Potts emphasizes the revolutionary contribution of the seeder-plough: by means of a simple funnel through which grains are dropped in the furrow, the seeder-plough allowed to optimize the seeding process, minimizing the losses and consequently contributing to the otherwise inexplicable Mesopotamian seed-to-yield ratio (up to 1 to 30) (Potts 1997: 82). Thus "*In many respects the seeding plough* [...] *was arguably the most important piece of technology ever developed in Mesopotamia*" (Potts 1997: 78). The earliest certain identification of the seeder plough in Mesopotamia dates to the Early Dynastic Period (generally ca. 2900-2350 BCE), in forms of iconographic representations on glyptic (Potts 1997: 78, and references therein). The seeder plough appears to have been unknown in the traditional early modern and contemporary Anatolian agricultural system, which was relying on simple wooden hook-plough, known in Turkish as *saban* (Dercksen 2008a: 145-146, and references therein). It remains unclear whether with the Assyrian the seeder plough was actually introduced in Anatolian agriculture. Surely, if this hypothesis is confirmed, it would have corresponded to a very important advancement in local agricultural practice.

After the harvest, the shelves were taken from the fields (*eqlum* or GÁNA) to the *adrum* – the Akkadian term indicating, at *Kaneš* and in Mesopotamia, the threshing floor (Dercksen 2008a: 146). The threshing floor at *Kaneš* was managed by a specific functionary, the "chief of the threshing floor" (*rabi adrim*). It appears that the communal threshing floor was divided into sections, as indicated by the recurrent reference to "*threshing floor of* [Personal Name]".

In the documents from *Kaneš* the threshing floor is often mentioned in debt notes and letters as the place where grain loans were repaid (Dercksen 2008a: 147). Grain debts are comparatively commonly attested in the texts from *Kaneš,* often in order to compensate for shortages in seeds for sowing (Dercksen 2008b: 87-91). Grain lenders are usually local dignitaries, who, in some instances, appears to have controlled very large quantities of staples – for example, Šiwašmi, a local priest, lent 160 sacks of barley (tentatively ca. 19,200 liters) (Kt 89/k 358) (Donbaz 1996: 193). These grain debts often involved groups of people, which on a prosopographical basis likely belonged to different families. Dercksen (2008b: 89) interpreted these instances as possible evidence for the presence of some form of communal land tenure. Debtors were most commonly Anatolians and entire villages were also listed in debt notes (Dercksen 2008b: 87). The debt contracts involved a collateral, which often was in the form of an additional amount of crop or a portion of the farmed land itself (Dercksen 2008b: 87).

In addition to grain loans, both barley and wheat are often involved in 'market-like' transactions (Dercksen 2008b). Grains are included in exchanges between Anatolian and Assyrian traders, possibly as part of commercial operations (Dercksen 2008b: 91-92). Quantities of grains are, furthermore, attested as a form of interest on loans of silver (Dercksen 2008b: 91). Smaller quantities of barley and wheat are also often exchanged for other goods (Dercksen 2008b: 91-92). In short, cereal grains appear to have functioned in all regards as a 'currency' for exchange, at various levels and scales of transactions attested in the archives from *Kaneš*.

According to Michel (1997: 100), the price of a bag of barley was between 1 and 5 shekels of silver, while the same amount of wheat would correspond to 5 to 15 shekels. The latter (*aršātum*) is documented in prices up to 30 shekels of silver. Two important considerations should be made in this regard: (*i*) as highly expected, and assuming the correct translation of the terms, wheat is significantly more expensive than barley; and (*ii*) the prices show important fluctuations. The latter point can be speculatively explained by the presence of different qualities, more or less valuable, as well as intra- (e.g., right after the harvest or before the sowing) and inter-annual (e.g., connected to the productive volatility endemically of central Anatolia agriculture) variability in grain supply. It is, accordingly, not surprising to find in a debt-note (Kt d/k 20) a clause noting that if the debtor opts to repay the debt in barley rather than silver, the exact amount has to be established based on its "rate of exchange" (*kīma izzazzu*) (Dercksen 2008b: 91-92). Finally, based on two texts, it has been proposed (Dercksen 2008b: 93) a pro-capita consumption of grain of 20/30 liters a month: "*the slave girls consume 20 liters and I* *myself consume 20 liters (per month)*" (BIN IV 22) and "*I give you each month 2 shekels of silver and 30 liters of wheat for your food*" (CV XXVI 118).

- *Pulses, fruits, and vegetables: gardens at* Kaneš

In addition to arable fields, gardens represented a second important component of the agricultural landscape orbiting around *Kaneš*. In the documentary record, the term *kirium* appears to indicate this general type of land use, under which are included orchards, vegetables gardens, and vineyards. The central administration directly owned and managed gardens, as documented by the attestation of titles, such as "gardener" (*nukaribbum*), "chief of the gardens" (*rabi kiriātim*), and "chief of the vegetables" (*rabi warqē*) (Derckers 2008a: 150-151).

Grapes are only occasionally attested in the tablets from *Kaneš* (Michel 1997: 104-105). The presence of vineyards could be, however, inferred by the reference in some tablets to debts due "at the plucking of the grapes" (Dercksen 2008a: 151). Wine (*kirāmum*) is attested in moderate quantities, which suggest that it played a minor role in trade and local economy (Michel 1997: 104-105).

Fruit crops are only sporadically attested in the Old Assyrian record from *Kaneš*. According to Michel (1997: 106-107), other than grapes, the only two fruit crops that are attested are pomegranates and *allānum* – the latter representing either a nut or acorns, which was sold in jars (CAD, A-I: 354-1a). One proposed interpretation of the term *allānu* could hazelnuts (Sturm 2008; see also Fairbairn et al. 2013). Textual evidence for legumes is also rare, whose translation remains problematic (Michel 1997: 107), which are here not discussed. Pulses were winnowed the same as cereals and measured in jars or bags. Onions (*šumkū*) represented, somewhat surprisingly, a major agricultural product at *Kaneš*, often reported in texts in the amounts of various sacks (Mitchel 1997: 105, Dercksen 2008a: 151).

Among aromatic plants, in the texts are attested cumin, coriander, possibly mustard, and a *sardum* – the latter is an unknown crop likely indicating an aromatic plant that was purchased in liters (Mitchel 1997: 105). The presence of flax, finally, could be hypothesized based on the attestation of the "chief of the linen garments" (*rabi kita'ātim*) (Dercksen 2008a: 156).

- *Straw and Firewood*

In the general overview of the textual sources from *Kaneš*, a short note should be made on the trade in wood, firewood, and straw. Trade in these products is attested in documents from *Kaneš* (Barjamovic 2011, app. 1.4). To quote some examples: "I paid 1 1/2 shekels of silver for a wagonload of wood. I paid 1 1/6 shekels of silver for another wagonload. I paid 2/3 shekel of silver for (wood) shavings" (Kt a/k 537 (l. 1-6)) and "2 shekels for 2 wagonloads of straw. 1 ½ shekels for the reed" (BIN 4, 169 (l. 12-14)) (Barjamovic 2011: 45-46). Although limited, this evidence clearly indicates how fuel materials were a commodity of importance in the economy of a large sized urban town, such as *Kaneš*. On the contrary, I am not aware of any textual reference to animal dung.

- *Landownership*

It is likely that at *Kaneš* agricultural land was owned by private farmers, magnates of the palace, and possibly by the palace itself (Dercksen 2008a). Private ownership of arable land, gardens, and even entire villages is well documented by sale documents. According to Dercksen (2008a: 144), based on evidence from the archive of Peruwa ("chief of the shepherds"), these sales were often consequence of indebtment, due to the inability to repay a grain loans. The textual record indicates that both Anatolians and Assyrians owned agricultural land. Assyrian land ownership at *Kaneš* is notably confirmed by the so-called treaties from Level Ib (Günbattı 2004, Donbaz 2005), which contain stipulations protecting Assyrian possessions at *Kaneš*, including fields and orchards:

> "(62-66)You shall not covet a fine house, a fine slave, a fine slave woman, a fine field, or a fine orchard belonging to any citizen of Assur, and you will not take (any of these) by force and hand them over to your own subjects/servant" (Kt00/k6; Donbaz 2005: 65).

To date we lack information concerning the amount of land that was directly under the palatial control (Dercksen 2008a: 156-157). It is, furthermore, unclear whether the palace imposed a form of in-kind taxation on agricultural production – which is not to be confused with the complex system connected to the 'import' taxes (*nishatum*) that were regulating the Assyrian-Anatolian trade (e.g., Larsen 2015: 157).

Finally, Dercksen (2008a: 142-143) proposed the possible occurrence of some forms of joint or communal land use. This latter hypothesis is based on the singular occurrence of HA.LÁ.NI in association to fields, a term which is understood by the author as a logogram for *zittušu* "his share".

2.3.2 *Late Bronze Age: agriculture in the Hittite cuneiform record*

The establishment and development of Hittite cuneiform is considered to be a split from the Middle Bronze Age (Old Assyrian) literacy (Section 2.3.1). The introduction of cuneiform at the Hittite capital of *Ḫattuša*-Boğazköy is to be connected with Ḫattušili I military campaigns in Syria, in the mid-17th century BCE, and the deportation to Hatti of local scribes. The volume of writing at *Ḫattuša* appears to have progressively increased, at first exclusively in Akkadian and starting from the early 15th century also using the Hittite language. By the end of the 15th century BCE, Akkadian appears to not have been used any longer for internal purposes (van den Hout 2020). During the Late Bronze Age, cuneiform writing is attested together with a second (local) script, the Anatolian hieroglyphic. The sources considered in this overview originate exclusively from the cuneiform record. I provide an introduction to the Hittite period in Section 1.2.2. For a discussion of Hittite literacy, I refer the reader to van den Hout (2020) and references therein.

A total of ca. 30,000 Hittite tablets and tablets fragments have been so far published, which are mostly concerned with cultic and ritual matters (van den Hout 2020). As already noted, the extreme paucity of administrative documentation has been explained by a possible use for such tasks of medium others that clay tables (e.g., Marazzi 2007, Cammarosano et al. 2019) or to the presence of an (illiterate) local administrative practice (d'Alfonso and Matessi 2021).

In the Hittite cuneiform record, information concerning agriculture are more directly found in the so-called Hittite Laws (CTH 291-292) (Hoffner 1997), the *Feldertexte* (pseudocadastral texts) (CTH 239) (Souček 1959, 1963), the *Freibriefe* (exemptions) (CTH 223-225), and the *Landschenkungsurkunden* (royal land donations) (CTH 221-222) (Ruster and Wilhelm 2012). Important information can be, furthermore, mined from texts of various nature, such as royal edicts, the so-called instructions, letters, cult inventories, historical texts or treaties (Marazzi 2008, Klengel 2006). In this section, I will first provide a general overview of some key aspects of Hittite agriculture, namely: the cultivation of cereals, pulses, and various fruits and nuts, irrigation, and land ownership. It will follow a more specific discussion of a selection of sources.

- *Cereals in the Hittite sources*

In cuneiform Hittite, phytonyms are most commonly reported using Sumerograms, Akkadograms, and syllabic Hittite (Hoffner 1974). Regardless of the language and writing in use, the translation of several of these terms can be only tentatively established (e.g., Frantz-Szabo 2003-2005). In addition to the intrinsic difficulties in mapping ancient plant classification to modern counterparts, in the Hittite corpus the translation of cereal, and more in general plant, terminology is further challenged by the nature of the scrip and language in use: (*i*) it cannot be assumed that the Sumerograms or Akkadograms used in the Hittite contexts maintained the original meaning that was attributed to them in the original Mesopotamian ambit; (*ii*) similarly, it is not possible to uncritically rely on the translation of Sumerian and Akkadian terms provided in Hittite copies of Mesopotamian literature, given the fact that these translation are likely to reflect the original (Mesopotamian) meaning of the term (Hoffner 2001: 2002); and (*iii*) identification based on linguistic analysis of morphemes occurring in other modern or ancient languages could be misleading, given the documented semantic changes of the same root in different languages or periods (e.g., Powell 2003-2005).

The reference work on cereal terminology in Hittite Anatolia remains Hoffner's *Alimenta Hethaeorum*, published in 1974. More recently, the author provided a brief update on the topic, which included evidence not available at the time of *Alimenta* – most notably the archive from Maşat Höyük-*Tapikka*, published by Alp in 1991 (Alp 1991a, 1991b). In this latter publication, the author tentatively reconsidered some translations of cereal terms that he proposed in 1974. This revision was based, among other lines of evidence, on an analysis of the frequencies of attestations of a cereal term in the textual record, which were compared to quantitative attestations in the archaeobotanical record

(Hoffner 2001: 201-202). This attempt is surely to be praised, yet important methodological issues exist. Our archaeobotanical knowledge of Hittite Anatolia was, and unfortunately remains, unsatisfactory (Section 2.1.3), which could directly call into question the representatives of the available evidence. Emblematic in this case is the recent publication of the archaeobotanical results from the *silocomplex* of Boğazköy- *Ḫattuša*, the massive early 16th century BCE multi-chamber granary from the lower town of the Hittite capital. The study published by Diffey et al. (2020) indicates that the main crops stored in the granary were hulled barley (*Hordeum vulgare*), emmer (*Triticum dicoccum*), and einkorn (*T. monococcum*). In short, the newly published evidence from Boğazköy directly calls into question the assumption that free-threshing wheat was the main cereal crop in the Late Bronze Age, on which much of Hoffner's (2001) argument was based. I will return to this detail in a later section of the dissertation (Chapter 7).

The Hittite cereal terminology is in discontinuity with the Middle Bronze Age Old Assyrian record from central Anatolia (Section 2.3.1), as should be expected given the likely Syrian origin of Hittite cuneiform (e.g., van den Hout 2020). The Old Assyrian terms *ARŠĀTUM* and *UṬṬUTUM*, which are commonly attested at Kaneš and translated respectively as "wheat" and as a general term for grain, are not documented in Hittite documents (Hoffner 1974: 60). The Sumerogram GIG, which is equated to the Akkadian *ARŠĀTUM at Kanes*, is attested at Boğazköy and in other Hittite archives with its alternative meaning of "disease/illness" (Hoffner 1974: 60). On the contrary, the Sumerogram ZÍZ, which is not attested at Kaneš and that is translated as emmer in Mesopotamia proper, commonly occurs in the Hittite corpus (Hoffner 1974: 60).

There is consensus in the literature regarding at least seven terms in the texts from *Ḫattuša* that scholars believe refer to cereals: ŠE, ZÍZ(-tar), *halki*-, *šeppit*-, *karš*-, *kant*-, and *ewan*. In addition to Boğazköy, cereals feature prominently also in the small archive from the provincial town of Maşat Höyük-*Tapikka*, where the following terms indicating cereal grains are identified: ŠE, ZÍZ, ZÍZ KALAG.GA, *KUNAŠU*, *halki*-, *šeppit*-, and *karši*- (del Monte 1995: 126-129). In the following paragraphs, I will summarize the most common translation of these terms, following Hoffner (1974, 2001), del Monte (1995), and Bolatti Guzzo (2006)

The Sumerogram ŠE is regarded as a synonym of the Hittite *halki*-. There is considerable consensus in reconstructing two main meanings of the term: as a general word for "grains" and a more specific use to indicate "barley" (Hoffner 1974: 60-65, Hoffner 2001: 203-203, del Monte 1995: 126-129, Bolatti Guzzo 2006: 70-71). The latter is the standard translation of the term in Mesopotamia proper. In several texts, the terms ŠE/*halki*- are contraposed to ZÍZ(-tar), the latter is accordingly translated as "wheat" (Güterbock 1968, Hoffner 1974: 65-69; Hoffner 2001: 203-203, del Monte 1995: 126-129, Bolatti Guzzo 2006: 70-71). The evidence supporting the identification of ŠE/*halki*- as barley and ZÍZ as wheat is discussed at length by Hoffner (1974: 65-69), in brief: (*i*) the two terms are often cooccurring, either in contraposition or indicating altogether "cereals"; (*ii*) the available documentation indicates that ŠE/*halki* is cheaper than ZÍZ in the ratio 1:2, based on a selection of texts discussed by Hoffner (1974: 66-67); (*iii*) both grains were milled into flour and used as ingredients for bread-making; and (*iv*) if ŠE/*halki*- is also documented to be used as fodder, ZÍZ appears to have been destined exclusively for consumption by human or deities.

Based on the aforementioned considerations a translation of ZÍZ(-tar) as wheat appears safe. More problematic is to understand whether the term refers to “wheat” in general (Güterbock 1968) or if it indicates a specific variety. The second hypothesis appears to be likely, given the cooccurrence of ZÍZ(-tar) with other terms (e.g., at Boğazköy *kara-* and *kant-*) generally considered to refer to other wheat varieties (Hoffner 1974: 65-69). Hoffner (1974: 65-69) proposed an identification of ZÍZ(-tar) as bread wheat, based on: (*i*) ZÍZ described in some texts as “pure” (*parkuiš*), which is speculatevely regarded by Hoffner as a possible indication of a free-threshing cereal; (*ii*) the use of this cereal for bread making, which is otherwise not clearly evident in the textual records for other wheat varieties (*kara-* and *kant-*) (see, however, del Monte 1995: 126-131); (*iii*) the frequent occurrence of the term in the corpus, which would suggests that it indicates the most popular and widely used wheat, which – according to Hoffner – was bread wheat. This latter point is called directly into question by the recent published evidence from the *silocomplex* at Boğazköy, in which wheat is overwhelmingly represented by hulled forms (einkorn, *Triticum monococcum*; emmer, *T. dicoccum*) (Diffey et al. 2020). In Mesopotamia proper the Sumerogram ZÍZ is translated as emmer, corresponding to the Akkadian *KUNĀŠU*. This latter Akkadian term, which is not attested at Boğazköy, occurs at Maşat Höyük together with ZÍZ in seed lists (del Monte 1995), which unequivocally indicates that the two terms are indicating two distinct crops – thus, in Hittite cuneiform, either the Sumerogram or the Akkadogram changed its original (Mesopotamian) meaning.

At Maşat Höyük it is, furthermore, attested a cereal named ZÍZ KALAG.GA, which could literally translate as “hard wheat”. According to Hoffner the latter “may be *Triticum durum* or *compactum*” (Hoffner 2001: 203). A different interpretation is given by del Monte (1995: 127). Based on its appearance is low quantities in harvests, without being this crop listed in the grain-seeds that were sown, the author hypothesize that it could represent a 'tolerated' cereal weed growing together with the main crops, which in a western Asian contexts would suggest an identification as rye.

As already noted, the Akkadogram *KUNĀŠU* is attested at Maşat Höyük but not an Boğazköy (del Monte 1995). If the identification of *KUNĀŠU* as emmer and ZÍZ as bread wheat is accepted, it would be necessary to look for a syllabic equivalent for *KUNĀŠU* in the texts from Boğazköy. Hoffner (2001: 203) speculatively proposed the Hittite term *kant-* as a possible candidate, on the basis of its description as *warhuiš* "rough", which according to the author could point to a hulled cereal. Previously Hoffner (1974: 69-73) proposed an identification of *kant-* as einkorn. On the basis of a reattribution of *kant-* to emmer, Hoffner proposed to identify *šeppit* as einkorn (Hoffner 2001: 203), a grain that was previously tentatively identified by the author as variety of barley (Hoffner 1974: 77-80). The identification of *šeppit* as einkorn has been sustained also by del Monte (1995: 128). Del Monte, on the other hand, disagrees with Hoffner (2001: 203) in regard to the syllabic identification of emmer, for del Monte tentatively identified with the Hittite term *ewan-* (del Monte *1995*: 128), which for Hoffner represents a variety of barley (Hoffner 1974: 80-82, Kloekhorst 2008: 263-264).

A further term documented at Boğazköy and referring to a cereal is *karš-*, which is likely to correspond to the spelling karši- attested at Maşat Höyük (Bolatti Guzzo 2006: 72). According to the textual record, *karš-* is processed in flour (ZI.DA) or consumed roasted (*šaanhuwa-*). The term is attested together with *halkiš* ("barley"), but it never cooccurs with ZÍZ or *kant-* (Hoffner 1974: 73-77). This latter observation has led both Hoffner (1974: 73-77) and del Monte (1995: 128) to propose an identification of the term as a type of wheat. Finally, more recently Corti (2020: 239-240) has interpreted the cooccurrence of ŠE and ZÍZ in a festival text (Bo 3394 + KUB 31.57) rather than two separate nouns ("barley" and "wheat"), as ZÍZ in form of an attribute to ŠE – which, given the accepted translation of ŠE would result in "ZÍZ barley". Assuming that ZÍZ could have a secondary meaning as generic "naked grain" (Hoffner 1974: 69), the author speculatively proposes an identification of naked barley.

	Boğazköy	**Maşat H.**	Hoffner 1974	Del Monte 1995	Hoffner 2001
ŠE	x	x	barley/grain s.l.	barley/grain s.l.	barley/grain s.l.
ZÍZ	x	x	bread wheat	bread wheat	bread wheat
ZÍZ KALAG.GA		x	n/a	rye	macaroni/club wheat
halki-	x	x	barley/grain s.l.	barley/grain s.l.	barley/grain s.l.
KUNAŠU		x	n/a	emmer	emmer
šeppit-	x	x	barley variety	einkorn	einkorn
karš(i)-	x	x	wheat variety	club wheat	wheat variety
kant-	x		einkorn	wheat variety	emmer
ewan	x		barley variety	emmer	wheat variety

Table 2.11 – *Translation of the main terms attested in the archives from Maşat Höyük and Boğazköy, according to Hoffner 1974, Hoffner 2001, and del Monte 1995. Following standards, Sumerograms are indicated in upper case, Akkadograms in upper case and italics, Hittite terms in lower case.*

In Table 2.11 I provide a summary of cereal terminology reported in the literature reviewed in the previous paragraphs. On the basis of the considerations made in this section, it is clear that to date it is not possible to positively translate most of the terms referring to grains attested in the Hittite corpus. If a distinction between the general categories of "barley" and "wheat" could be in most instances safely achieved, identifications at a finer scale remains – to say the least – controversial. Further work in these regards is, thus, imperative. It should be furthermore noted that with the sole exception of a tentative identification of ZÍZ KALAG.GA as rye (del Monte 1995: 127), cereals other than barley and wheat have not yet been identified in the Hittite textual record. This latter observation appears to confirm archaeobotanical evidence in pointing to a minor economic role during the Late Bronze Age of rye, oat, and millet (Chapter 7, Marston and Castellano 2021: 344-345)

- The cultivation of cereals and the agricultural calendar in Hittite Anatolia

Having introduced to the main terminology indicating cereal grains in the Hittite cuneiform corpus, in the following section, I will discuss cereal-farming in Hittite Anatolia. In secondary literature this latter topic has been discussed by, among others, Hoffner (1974, 2001), Klengel (2006), and Marazzi (2008).

Before addressing the specific case of Late Bronze Age (Hittite) Anatolia, I will provide a brief general introduction to the cereal cultivation calendar that defined Anatolia and for agriculture more generally in western Asia and Mediterranean. The presence of relatively wet winters and dry summers is a characteristic defining the climate of the Mediterranean basin and of the regions of Southwest Asia under a Mediterranean climatic influence, including Anatolia (Section 1.1). The cultivation of winter cereals is particularly well suited to this seasonality, a fact hardly surprising considering that western Asian wild and locally domesticated cereals (most notably wheat and barley varieties) possess a winter growth cycle (Zohary et al. 2012). It is thus crucial for our purposes to fully understand the main steps in their cultivation: (*i*) sowing occurs at the beginning of the fall, in concomitance with the expected autumnal rains, or shortly before them. The moisture levels at and shortly after the sowing are crucial in determining the germination rate – i.e., the number of sown caryopses that develop into a plant; (*ii*) after germination and a first phase of growing, promoted by the available moisture, the crop undergoes, during the winter months, a phase of dormancy; (*iii*) at the beginning of the spring, the plants restart their growth cycle, thanks to higher temperatures and soil moisture – the latter enhanced in central Anatolia by snow-melting and a second peak in precipitation (Section 1.1.1). The available moisture during the phase of spring growing and earing is strongly correlated with the number of grains that reach maturation in each plant (Sen et al. 2012); (*iv*) the crop reaches maturation in the summer and then harvest occurs. This basic cultivation cycle defines the backbone of the traditional (Hillman 1984b, 1985) and ancient (Hoffner 1974) Anatolian and western Asian agricultural system.

It should be noted that Hoffner (1974: 42 and 66) opened the possibility that a summer cultivation regime of barley and wheat existed in Hittite Anatolia, a hypothesis which is based on a single attestation of an "autumn barley/wheat" (ŠE/ ZÍZ *zenantaš*) paired with a ŠE/ZÍZ *haššarnanza*. Given the very limited nature of the evidence, to date this hypothesis remains purely speculative, if not unlikely given the climatic context of central Anatolia.

In his seminal work, Hoffner (1974: 12-52) identified in the Hittite calendar the presence of four seasons, a view that has been maintained by Klengel (2006: 7-8). Based on this tetrapartite subdivision of the Hittite calendar, the following seasons are identified: (*i*) spring (*ḫamešḫa*(*nt*)-,), lasting from April to June and corresponding to the spring rains and snow-melting; (*ii*) summer (BURU$_{x}$), from July to October, named after the harvest; (*iii*) autumn (*zena*(*nt*)-), in the middle/end of October, which corresponds to cereal sowing; and (*iv*) winter (*gimm*(*ant*)-), from November to March. In more recent scholarship (Cammarosano 2018: 106, and references therein), it has been argued for a tripartite rather than tetrapartite subdivision of the Hittite year, pushing for a more restrictive understanding of the term BURU$_{x}$, considered to refer exclusively to the harvest rather than to a 'season of the harvest' (i.e., summer in Hoffner's schema).

Technical terminology, discussed by Hoffner (1974, 2001) and Klengel (2006), refers to agricultural implements used for tillage: *tekan-* (hoe), which could be made both in metal ($^{\text{URUDU}}$*tekan-*)

or wood ($^{\text{GIŠ}}$*tekan-*), $^{\text{GIŠ}}$*ḫaḫra-*/*ḫaḫḫara-* (rake?), and $^{\text{GIŠ}}$*šatta-* (not translated). The plough is indicated using the Sumerogram $^{\text{GIŠ}}$APIN and, possibly, the Hittite $^{\text{GIŠ}}$appalašša (Klengel 2006: 9-10). In the so-called Hittite Laws (Par. 178) it is reported a price of 12 shekels for the purchase of a plough (Hoffner 1997: 141-142). In the Laws (Par. 121) it is, furthermore, reported a fine of 6 (free man) or 3 shekels (slave) for plough theft, while formerly the thief was sentenced to death by plough oxen (Hoffner 1997: 110-111). It is unclear whether in Hittite Anatolia the seeder plough was in use, lacking textual evidence in these regards.

Cereal harvest (BURU$_{\text{x}}$) took place in the summer. This activity appears to have been common pertinence of the male population (Hoffner 2001: 205). Based on the Laws (Par. 158), it is possible to reconstruct the presence of hired workers employed during the harvest: "*If a* (*free*) *man in the harvest season hires himself out for wages, to bind sheaves, load* (*them on*) *wagons, deposit* (*them in*) *barns, and clear the threshing floors, his wages for 3 months shall be 1.500 liters of barley* (*= 3.75 shekels of silver*). *If a woman hires herself out for wages in the harvest season, her wages for 3 months shall be 600 liters of barley* (*= 1 shekel of silver*)" (Hoffner 1997: 127). The harvest was commonly conducted using the sickle ($^{\text{GIŠ}}$*sarpa*) (Klengel 2006: 9).

The harvest was bundled into sheaves (*šepa-*) and, generally using carts, it was brought to the threshing floor (KISLAḪ). The use of oxen in threshing operations is documented by the expression "oxen of the threshing floor" (KUB 13.4 iv 25; see Hoffner 2001: 205). After threshing and winnowing, grains were stored in "warehouses" ($^{\text{E}}$*garupḫai*), underground granaries (ÉSAG.ḪI.A,) (Hoffner 1974: 34-36, Fairbairn and Omura 2005), and storage jar/containers ($^{\textit{DUG}}$*ḫaršiyalli-*) (e.g., Cammarosano 2018: 143-

148). Chaff and straw (IN.NU.DA, *ezzan*) resulting from cereal processing were stored in specific facilities (É IN.NU.DA, *taišzi*) (Hoffner 1974: 37-38).

Cereals were processed into flour, from which a plurality of baked products, including pastries and breads (NINDA), were obtained. The latter are documented overwhelmingly in ritual texts, in this section I will not discuss this terminology, which is covered by the throughout analysis provided by Hoffner (1974: 129-220) and more recently by Hagenbuchner-Dresel (2002). In addition to being processed as flour, cereals were consumed also in form of porridge (BA.BA.ZA) and groats (*ARSANNU*) (Hoffner 1974). The grinding (verb *ḫarra-*, *marra-*) of the cereals was conducted at the mill (É^{NA4}ARA$_5$), literally the "house of the grinding stone" (^{NA4}ARA$_5$, *ḫarazzi*) (Klengel 2006: 11). This latter activity appears to have been commonly conducted by women, and in some instances also prisoner of wars (Klengel 2006: 11). The latter were often blinded, which appears to have been a widespread practice in Hittite Anatolia (del Monte 1995: 108-110).

Evidence regarding prices of cereal grains is very limited, which reflects a more generalized paucity in sources informing on their circulation. On the basis of the following passage – "*If a smith makes a copper vessel of one and half mina of weight, his fees should be one and half PA of ŠE;* (*if*) *he makes a copper axe of two minas weight, his fee* (*shall be one*) *PA of ZÍZ*" – Hoffner (1974: 67) proposed a price ratio of 1:2 between barley (ŠE) and wheat (ZÍZ). According to this calculation, the author integrated the fragmentary Par. 183 of the Laws as follow:

> "The price of 150 liters of wheat is one shekel of silver. The price of 200 liters (of barley is 1/2 shekel of silver.] The price of 50 liters of wine is 1/2 shekel of silver, of 50 liters of [... is . . . shekels

> of silver. The price] of 3,600 square meters of irrigated(?) field is 3 [shekels of silver. The price] o f 3,600 square meters of ... field is 2 shekels of silver. [The price] of a (field) adjoining(?) it is one shekel of silver" (Hoffner 1997: 146).

- *Pulses in Hittite sources*

In addition to cereal cultivation, horticulture and fruit growing represented a further central aspects of the Hittite agricultural system. In Hittite cuneiform, pulses are reported using Sumerograms having GÚ as initial elements. A total of four terms indicating pulses are identified in the texts from Boğazköy: GÚ.TUR, GÚ.GAL, GÚ.GAL.GAL, and GÚ.ŠEŠ (Hoffner 1974: 95-102). With the sole exception of GÚ.ŠEŠ, the same terms are reported also in the archive from Maşat Höyük (del Monte 1995: 128). The translation of these Sumerograms, beyond a general identification of pulses, is disputed in the literature. Hoffner proposed some tentative identifications, which strongly rely on the translation of these Sumerian terms, or of their Akkadian equivalent (if known), in Mesopotamia (Hoffner 1974: 95-102). The identification of these terms in the Mesopotamia context, however, has proven to be very problematic in the first place, as noted by Maekawa (1985: 99) and Powell (2003-2005).

The Sumerograms GÚ.TUR and GÚ.GAL in Mesopotamian contexts literally translate respectively as little and big bean/pea. This general etymology has favored in Mesopotamia the translation of GÚ.TUR as "lentil" and GÚ.GAL as "chickpea", a translation which has been maintained in the Hittite context by Hoffner (Hoffner 1974: 95-102). The original translation of these terms has been, however, called into question (see Powell 2003-2005: 21-22). Similar considerations apply to GÚ.GAL.GAL (big big bean), which is tentatively translated by Hoffner as "broad bean" (Hoffner 1974:

95-102). The Sumerogram GÚ.ŠES is not attested in Mesopotamia, as of Hoffner (1974: 95-102). The author, however, proposed to equate the latter with the spelling ŠEŠEŠ, which is considered on an etymological basis (ŠEŠ, "bitter") to correspond to "bitter vetch" (Hoffner 1974: 95-102). Pea, one of the main western Asia pulse crops, does not figure in the schema proposed by Hoffner (1974).

- *Vineyards, grapevines, and grapes in Hittite texts*

The topic of viticulture in Hittite Anatolia has been discussed in Gorny (1995: 147-162), in the survey of Hittite agriculture provided by Klengel (2006: 14-16), and in a recent contribution by Corti (2018).

In Hittite cuneiform the Sumerogram GEŠTIN can be used in order to indicate both "wine" and "vine", the latter meaning is generally (but not always) implied by the use of the determinative GIŠ ($^{\text{GIŠ}}$GEŠTIN). In Hittite, grapevine is referred as *e/ippiya-*, while *wiyana* indicates wine (Corti 2018, and references therein). The Sumerogram indicating wine (GEŠTIN) is often accompanied by additional descriptive terms, which suggest the presence of different varieties and qualities of wine – such as old, new, first-quality, good, less good, sweet, sour, red, and white wine (Gorny 1995: 153- 158). In addition to wine, raisins ($^{\text{GIŠ}}$GEŠTIN.ḪAD.DU.A) are an common grape product in Hittite sources, commonly figuring in ritual offerings (Gorny 1995: 158). Raisins are, furthermore, listed as part of the dried rations assigned for military campaigns, and as ingredients for the production of a specific type of wine (Gorny 1995: 158). Vineyards are indicated exclusively using the Sumerogram $^{\text{GIŠ}}$KIRI$_6$.GEŠTIN, which leaves unknown the Hittite syllabic counterpart of the term (Corti 2018, and references therein).

Although the bulk of attestation of grapevine and related products is associated to the cultic or palatial contexts (Gorny 1995:153), which to some extend reflects the nature itself of the available documentary records, vineyards are mentioned comparatively frequently in Hittite Laws (Hoffner 1997), possibly hinting to a greater importance of viticulture in Hittite Anatolia. Paragraph 48 of the Hittite Laws includes vineyards, together with child and land, among the belongings that are forbidden to be purchased from an *ḫippara*-man (i.e., “enslave”, “prisoner”) (Hoffner 1997: 58-59). The Laws Par. 56 indicates grape harvest among work obligations, in the specific case referring to coppersmiths (Hoffner 1997: 68). While Par. 105 includes the penalties to be paid in case of damages caused accidentally to a vineyard or orchard by agricultural fires:

> “[If] anyone sets fire to [a field], and (the fire) catches a fruit-bearing vineyard, if a vine, an apple tree, a pear(?) tree or a plum tree burns, he shall pay 6 shekels of silver for each tree. He shall re-plant [the planting]. And he shall look to his house for it. If it is a slave, he shall pay 3 shekels of silver (for each tree)” (Hoffner 1997: 102).

In addition to hinting at the practice of open agricultural burning, the aforementioned passage has been regarded as indicative of the possible presence in Hittite Anatolia of mixed orchards, in which grapevines were cultivated together with other fruit trees (Hoffner 1997: 199), a practice still common in the region (see Chapter 3). Of particular interest is also Par. 107, quoted below, which refers to the instances in which a vineyard is damaged by livestock:

> “If a person lets (his) sheep into a productive vineyard, and ruins it, if it is in fruit, he shall pay 10 shekels of silver for each 3,600 square meters. But if it is bare, he shall pay shekels of silver” (Hoffner 1997: 104).

Par. 101 (Hoffner 1997: 100-101) and Par. 108 (Hoffner 1997: 105-106) of the Laws described the sanctions for stealing a vine or a vine branch. The presence of these cases in the corpus of laws could be tentatively explained by the possibility to respectively transplant the plant or to reproduce it by clonal propagation. Par. 113 of the Laws, furthermore, discusses the instances in which a grapevine is willfully cut down, in this case the culprit has to provide to the owner an undamaged vine, until the damaged plant recovers (Hoffner 1997: 99). The high value of a vineyard is well-evidenced by Par. 185 of the Laws, in which it is reported that "*The price of 1 IKU* (*i.e., ca. 3,600 square meters*) *of vineyard is 40 shekels of silver*". As a comparison the price of the same amount of irrigated land, as of Par. 183 (Hoffner 1997: 146), is of 3 shekels of silver – 13-fold lower. In the same passage, it is also reported the price of ½ shekel of silver for 50 liters of wine. Of course, prices in the Hittite Laws have to be critically evaluated, without assuming a priori their correspondence to actual 'market' values.

Given the nature of the available documentary record, we have very limited information concerning the productive and technical aspects of viticulture in Hittite Anatolia. Vineyard workers ($^{\text{LÚ}}$NU.$^{\text{GIŠ}}$KIRI$_6$.GEŠTIN) are attested in singular instances (Corti 2018: 286-287). The practice of vine pruning could be inferred by the attestation of the *ippiyaš* (grapevine) festival, occurring in the spring and possibly associated with the seasonal trimming (Cammarosano 2018: 130-131). A similar interpretation is possible for the festival "of cutting the vine" ($^{\text{GIŠ}}$GEŠTIN *tuḫšuwaš*), which is, however, more commonly regarded in the literature as associated to the grape harvest (Cammarosano 2018: 135-136). In a recent contribution, Corti (2018: 289-292) discusses at length a passage contained in the cult inventory of the sanctuary of *Pirwa* (IBoT 2.131). The text is reported bellow, based on the restoration and translation proposed by Corti:

> “(15’)The vineyards for Pirwa are neglected. (There are) 2 ḫaršiyal[li]-vessels: (16’) 1 ḫaršiyalli-vessel of Pirwa and 1 ḫaršiyalli-[vessel] of [Hašgala]. (17’)And when Urḫi-Teššob re-established (the cult of) Pirwa, (18’)he spoke (as follows): “As long as they rebuild the vineyards, (19’)let the wine be provided by the temple!”, and from that da[y] on (20’)the ḫaršiyalli-vessel of Hasgala is (there). (Now), they no longer provide it (with cult offerings). (21’)He (i.e. the priest?) of Pirwa holds the sealed wooden writing boards of Mount Lihsa.(?) (22’)(Previously) they always delivered the wood – firewood and wood (from shoots) of the vine – (23’)to be spread on the altar. But now, since one shekel of silver (24’)as the salary (for one year/provision?) was established, and since (only) the second (payment) in four years (*scil.* half) [has been paid(?)], (25’)therefore the wood for Pirwa – firewood and wood (from shoots) of the vine – (26’)to be spread on the altar is no (longer) given. (27’)(Now) the second (*scil.* the remainder of the) payment has been given. Each year (*scil.* henceforth) (28’)the temple of the city of Šippa will remit one shekel of silver” (Corti 2018: 289-292).

The second part of the passage refer to deliveries of generic firewood ($^{\text{GIŠ}}$*waršama*) and of GIŠ $^{\text{Ú}}$e-ep-p-ya, this latter term could be translated as “green grapevine wood”, which according to Corti (2018: 291) could in turn indicate grapevine pruning trimmings. The price for these yearly firewood deliveries is of 1 shekel of silver, which corresponds to 150 liters of wheat, or 100 liters of wine based on Law par. 183 (Hoffner 1997: 146). It is, thus, to be assumed that a massive quantity of firewood and vine trimmings were present. The expression “to be spread on the altar” is interpreted by Corti (2018: 292) as a more general indication of providing these resources to the temple, as opposed to actually spreading. According to the interpretation given by the author, this text would point to the pruning of vineyards as a routine activity in Hittite Anatolia, which generated a sizable amount of biomass that was exploited as firewood – an aspect that finds direct archaeobotanical confirmation for the post-Hittite period in the archaeobotanical study included in this dissertation (Section 5.4.4).

- The orchard: other fruit threes

In addition to vineyards, a number of fruit tree crops are reported in the Hittite sources. As already noted, based on Par. 105 of the Hittite Laws (Hoffner 1997: 102), scholars have hypothesized that mixed orchards were part of the Hittite agricultural landscape. In a passage from the KI.LAM festival (KBo 10.24 obv III 6'-10'), Corti (2018: 296-295) proposed to recognize evidence of cultivation of grapevines 'wedded' to other trees – a practice well-documented in later periods (e.g., Powell 1996: 105) and still comparatively common today in Turkey. The translation of the terms referring to fruit crops is notoriously challenging. In Hittite cuneiform, these plant names are generally reported using Sumerograms, which translation attempts have proven to be problematic in Mesopotamia proper (Powell 2003-2005).

Based on its standard Sumerian translation, the Sumerogram $^{\text{GIŠ}}$AŠHUR is translated also in Anatolian as "apple" (Hoffner 1974: 38). The translation of the term in the Mesopotamia context is discussed by Powell (2003-2005: 15-16). According to the author the scrutiny of the lexical evidence confirms that the term likely refers to a Rosaceae (apple/pear/quince/medlar family) tree, possibly domesticated apple. Rosaceae tree crops, including apple and other fruit crops (e.g., pear and plum) that will be discussed in the following paragraphs, are traditionally regarded in archaeobotanical literature as latecomers in Old World agriculture (Zohary et al. 2012: 114-116). Rosaceae trees do not lend themselves to simple vegetative propagation, in contrast to other important fruit crops – such as grapevine, olive, fig, pomegranate, and date palm (Zohary et al. 2012: 114-116). In Rosaceae trees, cross-pollination promotes high levels of heterozygosity, which are connected to a tendency of these plants to segregate widely in phenotypic traits if reproduced by seeding (Zohary et al. 2012: 114-116). Their domestication is, thus, traditionally associated to the introduction of the technique of grafting, which in western Asia and the Mediterranean is attested in documentary sources starting in the mid-1st millennium BCE (Lonie 1981: 235-236, Mudge et al. 2009: 452-454). Considering the comparatively common attestation of $^{\text{GIŠ}}$AŠHUR in the western Asia cuneiform sources, if the translation of the term as "apple" is confirmed, it would necessitate a reconsideration of either the domestication history of the crop (i.e., with earlier propagation through seeding rather than cloning) or of the chronology of introduction of grafting in western Asia.

A similar set of issues becomes evident when trying to translate the two other Sumerograms: $^{\text{GIŠ}}$AŠHUR.KUR.RA and $^{\text{GIŠ}}$ŠENNUR. Given a translation of $^{\text{IŠ}}$AŠHUR as "apple", $^{\text{GIŠ}}$AŠHUR.KUR.RA would literally translate as either "apple of the mountain" or "apple of the foreign land". Based on the Semitic root of an equivalent Akkadian word (*armannu*), it has been proposed as a translation of the term as "apricot" (Hoffner 1974: 115, and references therein). The identification of apricots in 3rd (Sumerian) and 2nd millennium western Asia would be problematic, given the likely East Asian domestication of this crop (Powell 2003-2005: 15, Zohary et al. 2012: 144, Hoffner 1974: 115). A second Akkadian translation of $^{\text{GIŠ}}$AŠHUR.KUR.RA is "*kameššaru*" (Powell 2003-2005: 15), which on the basis of the root in Aramaic and Arabic is identified as "pear" (Powell 2003-2005: 18). Considering the widespread presence of wild pears (e.g., *Pyrus elaeagnifolia*, *P. pyraster*) in Anatolia and western Asia, this latter hypothesis is at least more reasonable on a phytogeographic ground.

The translation of the Sumerogram $^{\text{GIŠ}}$ŠENNUR is challenging, In Mesopotamia and as a consequence in Anatolia (Powell 2003-2005: 18-19). In some Mesopotamia texts $^{\text{GIŠ}}$ŠENNUR is equated to Akkadian "*šallūru*", which has been speculatively translated as "cherry plum" or "medlar" (Powell 2003-2005: 17-19). Powell (2003-2005: 17) considers this latter hypothesis unlikely, given an assumed minor economic importance of medlar due to its palatability necessitating of bletting.

Less problematic is the interpretation of the Sumerogram $^{\text{GIŠ}}$PÈŠ, which is commonly translated in Mesopotamia as "fig" (Powell 2003-2005: 17). There are no reasons to reconsider this translation in the Anatolian context (Hoffner 1974: 116). The Hittite syllabic writing of the term is unknown. In Hittite documents, $^{\text{GIŠ}}$PÈŠ is described as sweet (*maliddu-*) and we are told that it contained "1000 seeds". The fruit was eaten both fresh and sundried, and it was an ingredient for a special type of bread (NINDA.KUR4.RA $^{\text{GIŠ}}$PÈŠ) (Hoffner 1974: 116).

$^{\text{GIŠ}}$NU.ÚR.MA is regarded as the Sumerian writing indicating pomegranate, corresponding to the Akkadian term "*nurmû*" (Powell 2003-2005: 19). In Hittite cuneiform, it is commonly used the Sumerogram $^{\text{GIŠ}}$NU.ÚR.MA. The term "*nurati-*" has been proposed as syllabic writing of pomegranate in Hittite, based on similarity to the Hurrian word describing this crop ("*nuranti*") (Hoffner 1974: 119-120).

Given its distribution and ecological requirements, it is not surprising that it is not known a Sumerogram indicating the olive tree. In Mesopotamia the latter is attested by the Akkadian term "*serdu*" (Powell 2003-2005: 18). At Boğazköy the latter term is attested with the spelling $^{\text{GIŠ}}$ZÉ-ER-TUM (Hoffner 1974: 117-118). Of interest is the tablet KUB XI.2, which refers to an area in *Kizzuwatna* (Plain

Cilicia) with intensive olive framing (Hoffner 1974: 117).

A list other fruit trees, attested in single instances or of unknown translation, is provided by Hoffner (1974: 120), to which I refer for further information.

- *Irrigation in Hittite texts*

The extension of artificial irrigation into Hittite agriculture is still a poorly understood topic. The documentary evidence on this important aspect of agricultural production has been summarized by Hoffner (1974: 22-24) and further discussed, in relationship to cereal cultivation, by Marazzi (2008: 66).

In Hittite cuneiform, irrigation ditches are indicated using the Sumerogram PA$_5$, or Hittite *amiyar-* (Hoffner 1974: 22). The Hittite verb *šiššuriya-* has been translated as "to irrigate", to which derives the adjective *šeššuraš/šiššuraš,* "irrigated" (Hoffner 1974: 22, and references therein). The importance of irrigation and canal maintenance is well documented by the inclusion of these duties in the instructions for the Frontier Post Governors: "*the* ḫuppidanu-*installations and the canals shall be cle*[*an*]*ed up*" (CTH 261.I, 54, 57' 59') (Miller 2013: 231). Paragraph 162a of the Hittite Laws, furthermore, provides the example of disputes for canal alterations:

> "If anyone (totally?) diverts an irrigation ditch, he shall pay one shekel of silver. If anyone upstream(?) partially(?) diverts an irrigation ditch, he/it is ...ed. If he takes (the ditch at a point) below (the other's branch), it is his (to use)" (Hoffner 1997: 129).

In the Par. 183 of the Laws, already quoted in relation to grain and wine prices, it is reported the price of one IKU (~3600 m^2) of irrigated (3 shekels) and HA.LA.NI (2 shekels) land (Hoffner 1997: 146).

The presence of canals and irrigation is, thus, well-supported by textual evidence. More problematic is the reconstruction of the actual extension of the irrigation system and the portions of the landscape that were artificially watered. Regarding the latter question, the irrigation of orchards, gardens, and vineyards is comparatively well attested. For instance, Par. 109 of the Laws states that:

> “If anyone cuts off fruit trees from (their) irrigation ditch, if (he cuts off) 100 trees, he shall pay 6 shekels of silver” (Hoffner 1997: 106).

The penalty to be paid is sizable, considering the price of 1 shekel of silver for 150 liters of wheat, as reported in Law Par. 183 (Hoffner 1997: 146). Both the presence of canals and irrigation of fruit crops are, thus, well-supported by textual evidence. On the other hand, the question concerning the possible irrigation of arable land remains controversial. On this regard, an important piece of evidence originates from the so-called *Feldertexte* (CTH 239; Marazzi 2008), a group of ‘pseudo-cadastral’ tablets listing and describing fields according to location, qualitative characteristics, dimensions, ownerships, and quantity of sown grain-seeds. It is important for our discussion to note the distinction therein made between *hatantijaš* and *šeššuraš* fields – translated respectively as non-irrigated (literally dry) and irrigated plots (Marazzi 2008: 66).

Hoffner (1974: 22) pointed also to the attestation of the expression “*šešuraš* ZÍZ-tar”, which would translate as irrigated wheat. It is, however, unclear to me whether this term is attested only in Mesopotamian literature translated in Hittite, or if it genuinely indicates the presence of irrigated wheat in Late Bronze Age central Anatolia.

- *Administrative and Juridical structure: tenure, obligations, taxation*

As pointed out by Marazzi (2008: 64), our knowledge of the administrative and legal basis of Hittite agriculture is, to say the least, far from satisfactory. Central aspects connected to the juridical organization of agricultural production are still poorly understood and debated in the scholarship, an aspect that holds important implications for our understanding of the social structure of the Hittite state itself (e.g., Bilgin 2019: 7).

The available sources support the presence in Hittite Anatolia of a centralized administrative system, which commanded the extraction of both staple foods and labor, respectively in the form of taxes and service obligations (e.g., Torri 2016). The local "palaces" (É.GAL) and the so-called "houses of the seal" (É NA^{4}KIŠIB) formed a partially overlapping network of administrative centers present throughout the Hittite domain (d'Alfonso and Matessi 2021: 136-137, and references therein). The "houses of the seal", which functioned as state storehouses, were overseen by the $^{\text{LÚ.MEŠ}}$AGRIG (Singer 1984). In addition to the local storehouse, an AGRIG-official concurrently administrated over a parallel institution at *Ḫattuša* (Singer 1984: 113). The office of the AGRIG appears to have been at the center of the administrative reform conducted by Telipinu in the mid-15th century BCE (Telipinu Edict, CTH 19; Hoffman 1984).

The household (É + [personal name]; see Klengel 1986) is regarded as the main economic unit at the base of Hittite economy, including agricultural production (Klengel 2006: 6). These households were composed of either nuclear or extended families, to which could have been added additional workers – including slaves, deportees, and occasionally also hired labor (Klengel 2006: 6). The assigning of deportees (NAM.RA$^{\text{MEŠ}}$, Hittite *arnuwala*-) appears as a distinctive feature of the empirical period, which was likely aimed at assuring the needed agricultural workforce (Torri 2016: 39-40).

The so-called *Landschenkungsurkunden* (CHT 222; Rüster and Wilhelm 2012) are documents in which it is recorded the royal donation of agricultural estates, having both individuals and institutions as beneficiaries. In addition to arable land, orchards, pastures, and woods, these donations also included entire households (É [p.n.]) (Wihelm 2009: 222-223). The latter appear, thus, to have been directly bunded to parcel of lands, and as such being included in these assignations. Two central questions arise: what was the juridical status of the members of these households? And were these settlements the exception or the norm in the social-economic landscape of Late Bronze Age central Anatolia? The answer to these questions has important implications to a general understanding of the Hittite state (e.g., d'Alfonso 2010a). Güterbock argued for the presence of a feudal organization of the Hittite domain, seen in these households a social class of "*unfree in the sense of 'serf' and* 'glebae adscripti'" (Güterbock 1972: 94). Scholars such as Diakonoff (1967, 1982), Archi (1973), and Imparati (1982) proposed the presence of a two-level system, which included villages of 'servs' under direct control of the secular or religious institutions, and free communities composed by landowner, which obligations towards the central authority were exclusively in form of taxes and services.

In addition of the juridical status of the "ploughmen", a further central question concerns the forms of landownership present in the Land of Hatti (Giorgadze 1998, Klengel 2006). The central administration directly owned agricultural estates: the "fields of the palace", which were part of the É$^{\text{MAŠ}}$ LUGAL. As already noted, the king could dispose of these estates, which could be assigned to both individuals and institutions. If special exceptions were not in place (see Haase 2008), the beneficiaries of these assignations were responsible for fulfilling state obligations (*saḫḫan* and *luzzi*; see Haase 2003). Agricultural land appears to have been owned also by temples and religious institutions, as documented by the attestation of the so-called "God's Fields" (A.ŠÀ DINGIR^{LIM}) (Giorgadze 1998: 96).

Within the tentative picture provided in the above paragraphs, the actual extension of private land tenure in Hittite Anatolia remains unclear. Nevertheless, private ownership appears to have been part of the central Anatolian Late Bronze Age legal system, as suggested for examples by the Paragraphs 46 and 47 (Hoffner 1997: 54-56), 146a (Hoffner 1997: 120-121), and 169 (Hoffner 1997: 135-136) of the Hittite Laws. Paragraph 146a is particularly significant in pointing to the possible existence of a land ownership market, the passage reads as follow:

> §146a "If someone is in the process of selling a house, a village, a garden or a pasture, but another (seller) goes and strikes first(?), and makes a sale of his own instead, as a fine for his offence he shall pay 40 shekels of silver, and buy [the ...] at the original prices" (Hoffner 1997: 120-121).

Prices for the purchase of agricultural land are reported in Par. 183 (1 IKU arable land 3 shekels of silver, 1 IKU ḪA.LA.NI field 2 shekels, 1 IKU field adjoining (?) 1 shekel) and Par. 185 (1 IKU of vineyard 40 shekels of silver) of the Hittite Laws (Hoffner 1997).[7] If no special exceptions are in place, the obligations associated with the land appear to have been transferred together with its ownership, as shown in several specific cases discussed in the Hittite Laws (Giorgadze 1998: 96, Marazzi 2008: 64-65).

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[7] Hoffner does not provide a translation of the term ḪA.LA.NI. According to Dercksen (2008a: 143-144, with previous literature) this term might indicate a joint or communal system of land use: ḪA.LA "share" + NI possessive suffix.

Having provided a general overview on some of the main aspects of Hittite agriculture, as documented in the textual record, in the following paragraphs, I will present a selection of sources.

- *Selected sources: The Instructions for the Frontier Post Governor* (*CTH 261.I*)

The so-called instructions consist of *"the royal prescription of a set of obligations or instructions* (*Hitt.* isḫiul-) *addressed to a professional class or classes within the internal state administration*" (Miller 2013: 1). The entire corpus of the Hittite Royal Instruction texts has been published by Miller (2013), to which I refer any interested readers for a further discussion of this genre, including its location within the Hittite scribal and administrative system and modern Hittitological research (Miller 2013: 1-8).

Agriculture was a matter of central importance for the Hittite administration (e.g., Marazzi 2008). It is, thus, not surprising that it figures comparatively frequently in instructional texts –e.g., texts 5, 7, 8 13, 17, 20 and 22 in Miller 2013. Within this corpus, of particular importance are the so-called Instructions for the Frontier Post Governor (CTH 261.I), which informs on the seasonal organization of agricultural works (Miller 2013: 212-237). These instructions, attributed to the reign of Arnuwanda I (early 14th century BCE), were addressed to one of the highest local officials, the *BĒL MADGALTI* – literally the "lord of the watchtower" (Hittite *auwariyas isḫas*) (Beckman 1995). As noted by Marazzi (2008: 71-75), the involvement of the *BĒL MADGALTI* in agricultural production, and administration appears to have been centered on four main ambits, which were: (i) to distribute grain-seeds and workforce; (ii) to expand cultivations to unfarmed land plots, either because in a fallow year or because left untilled; (iii) to oversee the storage of agricultural products, in granaries and storerooms; and (iv) to oversee the winter and spring works in fields and orchards. Given the relevance of this text, I report below a selection of passages, together with a brief commentary. The edition and translation reported is based on Miller (2013: 212-237).

Paragraph 27 lists, among the duties of the frontier post governor, the overseeing of firewood procurement, providing specific measures (which vary in the two parallel versions of the text). This passage, once again, points to the economic importance of firewood, an aspect that already emerged in other sections of this chapter.

> §27a' (5'-7')And the governor of the post shall organize the firewood in the fortified towns as follows: it s[(hall b)]e 12 fingers in diameter, while it shall be 1 ell and 4 hands in length. (8')The [m(a- .. . -wood)] shall be 3 fingers in diameter, while it (9')shall be [(1 el)]l in length. There shall be lots of wood inside(?)_ (10')[...] furniture; there shall be much of everything.

Paragraph 29 provides indications concerning the construction and maintenance of infrastructure present at the frontier post and its adjacent territory – including the threshing floor, the straw depot, and irrigation structures. The latter are associated in the text to orchards, gardens, and vineyards.

> §29' (l6')The plaster that crumbles down, though, (17'-18')they shall regularly remove from the walls, and they shall expose the foundation stones. Further, the threshing floor, the straw barn, the shrine, (and) (19')the water installations for the orchards, gardens, (and) vineyards (20')must be properly constructed.

Paragraph 41 covers the attribution of grain-seeds, livestock, provisions, and fields to the workers that have been relocated by the central institution. It is emphasized as these assignments have to occur quickly.

> §41' (36–39)you must keep an eye on a deportee who has been settled in the province with regard to provisions, seed, cattle (and) sheep; further, you must provide him with cheese, sourdough, (and) wool. Whoever remains in place of a deportee who leaves your province, though, (40)you yourself must sow seed for him. Furthermore, he must be satisfied with regard to fields, (41)s[o] they shall promptly assign him a plot.

The first part of this portion of the text is fragmentary. It is, however, pertaining the overseeing of land and livestock.

> §42' (42)[...] the supervisor of the land tenants, fields, forest, orchard (43)[...]and the palace supervisor[...] cattle, sheep (44-46')[...] of the palace [...]
>
> §43' (47')[... sh]eep, hors[es ...] (48')[...] he shall keep/hold, and (49')[... o]f the palace [...] (50')[. ..] he keeps/will keep [...]-ed (51')[...] shall not [...] it/ him.

As part of seasonal works, paragraphs 44-45 emphasize the importance of the maintenance of irrigation canals. This section has been already discussed in relation to the general topic of irrigation in Hittite Anatolia.

> §44' (52') [. ..] t[hey?] shall continually prepare[...] with (53'-54')[. . (of) ...] the forests? (and) walls [shall be] well bu[ilt ...]. [(Further)], you shall irrigate [(th)]em with water. (55')[(Al)so (the pasture)] you shall irrigate with [wat]er. (56')[(And)] you shall not let[...] graze [(on it)].

§45' (57'-59')[(Further, the) garde]ns$^?$ (and) vineyards [(mus)]t be well made (and) bu[ilt]. Further, the *ḫuppidanu*-installations and the canals shall be cle[an]ed up. Further, the word/matter of the scout [must (b)]e taken seriously.

Paragraphs 46 concern the overseeing of grain-seeds distributions, with the main aim of avoiding missuses and frauds.

§46' (60')When, however, they sow seed for depo[(rte)]es, the governor of the post (61'- 64')must keep his eyes on all of them as well. But if someone speaks thus: "Give me seed, and I will sow it in my field, then I will heap up stores (of grain),"then the governor of that very post must keep (his) eyes on (him). (65')When the harvest arrives, then [he shall ha]rvest that field.

Paragraph 47 concerns the distribution of fields that were previously left uncultivated. It is noted the necessity to maintain a written record of such fields, and to promptly assign them for cultivation as soon as the necessary workforce is available. The rationale on which Hittite agriculture is based appears, thus, to have been based on a maximalization of the available resources, encompassing both grain-seeds reserves, arable land, and labor. In this passage it is, furthermore, emphasized the importance of assuring that these new fields are well prepared (tilling?).

§47' (66'-67')Also the fields of a run-away land tenant and land allotments that are empty shall all be recorded for you. (68'-70')But [w]hen they allocate deportees, they shall promptly assign them a place. And you shall keep an eye on the *walḫuwant-* for the fields with regard to their construction, (71')and they shall be well built.

Paragraph 48 covers horticultural works, which are of difficult interpretation given the fragmentary nature of this portion of the text.

> §48' (72')And you shall take care of the matter of the works. And (73')the *pistali* (and$^{?}$) the *kapanu*$^{(?)}$-bulbs shall be[...]-ed. (74')And the foliage, the works [...] (75')[.. .] shall be [...]. But if/when a/the temple [...] (76')[. ..] it shall be 4 ell.

In paragraph 53 it is discussed the activity of overseeing the grain-seeds from the farmed fields.

> §53' (9'-10')You must [(also)] keep an eye on al[l the ...] (and) the palaces [(i)n your] province. (11'- 12')you must also keep an eye on the seed for the [(ploughed fields)] and the land allotments of the palace servants.

Paragraph 54 includes among the duties of the official the control of the granaries, in order to avoid any non-authorized use of the grains therein stored, either for sowing or consumption. It is noted the presence of an administrative record of the stored grains, using wooden tablets (on this topic see Marazzi 2007, Cammarosano et al. 2019, and references therein).

> §54'a (13'-15')And you shall inquire into the palaces and noble estates that are in your [p]rovince, whether someone has damaged anything, or whether someone has taken anything, (16'-17')or whether someone has sold anything, or whether someone has broken into a granary, or whether someone has killed royal cattle, (18'-19')or whether someone has consumed the grain stores the illicitly destroyed the wooden writing boards. (20')You shall keep track of it.

Paragraphs 55 and 56 covers the winter agricultural duties, which included to oversee the royal cattle and the works in the field in preparation of the harvest, to monitor the conditions of the gardens, to conduct fencing works, and to provide forage for livestock.

§55'a (21 '-22')Or if someone has something away from the servants, the governor of the post shall apprehend him, (23'-24')and he shall have him brought before His Majesty. And in winter he must keep an eye on the royal cattle, and you shall tend to the winter (and) harvest labor. (25')The kitchens shall be in order. Ice shall be collected, (and) an ice-house shall be built.

§56' (29')[... (Further)], (30')[(you shall) keep (track of)] the plants of the gardens, [(and they shall be placed within a fence)]. (31')A three}[old?] portion is for the *parzaḫanna*-cattle, [(and they shall regularly eat that portion)]. (32')And no o[(ne)] shall [give] them in excess (of that). [Who(ever)] (33')gives [(them)] in excess (of that), though,[...]. (34')And where/when the/a cultivated field [... , (but where/when) ...] (35'hn the meantime, and the fields [...] forth. [...] (36')And in one direction 1 ell and 5 hands [...].

Paragraphs 57 and 58 discuss the agricultural work to be conducted in the spring. Marazzi (2008: 74) noted that the tillage works indicated in this passage could have been associated to the late winter/early spring pick in rainfall. Tillage in this season could have been aimed at maximizing the moisture stored in the fields during the green up and ears formation period.

§57' (37')And when the cattle are late, (and) [f(urther) ... (forth)], (38'-40')they shall plough 10 m. and 5 ell in one way [(and 10 m.) and (5 ell land) the other w(ay)]. Further, (when) spr[ing arrive(s, you shall take care of the seed of the palace)], the servants (and) the chief land tenant, [(and you must keep an eye on)] (them). (41'-42')Further, until sprin[g arri(ves)], they shall prepare down [(in the *tiyeššar*-orchard)]. [...] .

§58' (43')And as soon as spring [arrives, …] (44')that remains, it […].And as soon as(?) […] (45')in/to another town […].The ploughman, though, [… (the work)]. (46')And as soon as the provinci[al (governor)] comes b[ac]k, […] (47')he will see[…], and [he will (count/keep track of) …] for hi[m]. (48')And the cattle[…] to him. (49')But if/when the work[…].

- *Selected sources: letters and administrative texts from Maşat Höyük*-Tapikka

The site of Maşat Höyük is located in the Tokat Province, about 100 km to the northeast of the Hittite capital Boğazköy-*Ḫattuša* (Figure 1.12). Between 1973 and 1981, Tahsin Özgüç conducted a large-scale excavation at the mound site (Özgüç 1978), which led to the discovery of the largest (published) Hittite archive outside *Ḫattuša*. The textual corpus from Maşat Höyük consists of a total of 117 tablets and tablet fragments. The main edition of the Maşat Höyük archive was provided by Alp (1991a and 1991b), while specific aspects have been discussed by a number of scholars – including the administrative evidence (del Monte 1995), the local administration (Beckman 1995), and the epistolary correspondence (Hoffner 2009). With the sole exception of two fragments, these tablets originated from the destruction level of the local palace (Level III), which is dated to the early 14th century BCE (van den Hout 2007: 389). There is consensus regarding the fact that a short timespan is covered by this archive, possibly extending across a single generation, likely during the reign of the Tudḫaliya III (van den Hout 2007: 389, and references therein).

The site of Maşat Höyük has been identified with the Hittite toponym of *Tapikka* (van den Hout 2007), a town located on the northern frontier of the Hittite territory. The northern border of the Hittite kingdom was constantly under pressure from the neighboring Kaška-people (Glatz and Matthews 2005, and references therein) (Section 1.2.3). The archive of Maşat Höyük includes 98 letters, 17 administrative texts, and 1 oracle tablet (van den Hout 2007), which informs on the military and administrative activities in this border region of the empire. In the following paragraphs, I will introduce the evidence on agriculture present in this corpus, discussing a collection of letters and administrative documents.

The letters from Maşat Höyük involve the Hittite great king and a number of officials, based at *Ḫattuša*, at *Tapikka*, or elsewhere. The core of officials involved consists of Ḫattušili, Ḫimuili, Ḫuilli, Ḫulla, Kaššu, Merešle, and Uzzu. Beckman (1995) provides a discussion of these officials within the Hittite administrative hierarchy, to which I refer for further information. Among these officials, Ḫattušili and Merešle appears to have been in the close circle of the king. Ḫimuili figures as the frontier post governor (*BĒL MADGALTI, auwariyas isḫas*;) of *Tapikka*, while Kaššu was the "Chief of the Army Inspectors" (UGULA NIMGIR ÉRIM.MEŠ). Agricultural matters are a recurrent topic in the correspondence preserved in the Maşat Höyük archive, directly involving the great king himself – e.g., letters HKM 8, HKM 17, HKM 4, HKM 34, HKM 37 (Hoffner 2009). On the basis of these letters, the hostile activities conducted by the Kaška appear to have consisted of rather small raids, during which they plundered grain fields and livestock. Within this context, the loss of the harvest due to the hostile incursions of the Kaška appears to have represented the main threat to the Hittite administration – e.g., letters HKM 8, HKM 17, HKM 18, HKM 19, HKM 24, HKM 25, HKM 50 (Hoffner 2009). It is, thus, not surprising that one of the central tasks of the highest officials present at *Tapikka* was to secure the harvest, to properly distribute the grain-seeds, to safely store grain, and fulfill their delivery to the capital. These letters complement and integrate the discussion of the Instructions for the Frontier Post Governor (CTH 261.I), providing a vivid glimpse into administrative and agricultural life in a territory at the border of the Hittite domain.

Due to space limitations, in this section, I will present and discuss only a select set of letters. I will, in particular, concentrate on two groups of letters, which more directly and explicitly inform on Hittite agriculture. In both instances, these groups could represent part of a single correspondence; although, the specific sequence is of problematic reconstruction (van den Hout 2007).

A first dossier includes the letters HKM 8, HKM 18, HKM 19, HKM 21, HKM 24, HKM 25, and HKM 45 (Hoffner 2009). Locust swarms, according to HKM 19, destroyed the crops of the Kaška, who in response raided the Hittite territory: they plundered the harvest while still in the field, attacked the royal storerooms, killed cattle, and abducted people. The Hittite countermeasures appear to have included: (*i*) the deployment of troops (e.g., HKM 19, HKM 24); (*ii*) to accelerate the harvest in order to secure all the remaining crop present in the fields (HKM 25); and (*iii*) to buffer the famine originating from these raids, by redistributing the grains stored in nearby royal storerooms, which were however originally intended for sowing (HKM 24, HKM 45). In the following paragraphs, I report the most significant letters within this correspondence. The translations provided are based on Hoffner 2009.

HKM 19: From the King to Kaššu and Pulli.

> (1-3)Thus speaks His Majesty: Say to Kaššu and Pulli (4- 8)Concerning what you (sg.) wrote to me, saying: "The crops are already ripe, but in the Kaškaean territories a plague of locusts has devoured the crops." (9-17)"As a result (Kaškaean people) are setting upon the (Hittite) crops in the region of *Kašepura*. There are no troops and chariotry here. Your Majesty instructed Kallu, the (Royal) Stable Master, 'Dispatch chariotry (to *Kašepura*),' but as of now no chariotry has

come." (18-22)I, My Majesty, have just apprehended Kallu, and he told me: "I already dispatched twenty team (i.e., pairs of horses) of chariotry." (23-25)I have just dispatched Paḫinakke too after (them), and he is coming. (Hoffner 2009: 129-131)

HKM 8: From the King to Kaššu.

(1-2)Thus speaks His Majesty: Say to Kaššu: (3)Concerning the matters about which you wrote to me: (4- 5)how the enemy is damaging the crops, (6-7)how in *Kappušiya* he has attacked (the property) of the House of the Queen, (8)how they have taken? one team of oxen belonging to the House of the Queen, (9-10)and how they have led away captive 30 oxen and 10 men of the serfs (lit. poor people)- (11)(all this) I have heard. (12-14)Because the enemy thus marches into the land at a moment's notice, (15)you should locate him somewhere, (16-17)should attack him. (18)But you must be very much on highest alert against the enemy. (Hoffner 2009: 108-110).

HKM 24: from King to Pišeni.

(1)Thus speaks His Majesty: Say to Pišeni: (2-3) They have brought here the two fugitives that you dispatched. (4-10)Regarding the following which you wrote me: "The *zaltayaš*-troops who went to *Kašepura*, ... in a famine, are saying the following: 'When the Kaška-men come, should we go out after (them) and bring them up (here)?'" (11-19)(His Majesty answers:) Because Takša drove here, let him lead the troops of *Kašepura* and the troops of *Marišta*. Let him proceed to take grain of the palace for cultivation?. If he has come up, right now he will lead troops from *Kašepura*. If he leads any other (troops), let him take grain for them for cultivation?. (20-22)Then break/tear (open?) behind ... , and they will proceed to replenish it in the harvest season.

(Hoffner 2009: 136-140).

HKM 25: from King to Tatta and Ḫulla.

(1-3)Thus speaks His Majesty: Say to Tatta and Ḫulla: (4- 10)Pišeni has just written me from (the town of) *Kašepura*: "The enemy is moving en masse at night-sometimes six hundred, sometimes four hundred of the enemy-and is reaping (our) crops." (11-19)As soon as this tablet reaches go to *Kašepura*. If the crops have ripened, reap them and transport them to the threshing floor. (20-21) Do not let the enemy damage. (22-25)I have sent you herewith the tablet of Pišeni. Have it read aloud in your presence. (Hoffner 2009: 140-141).

HKM 45: passage from a broken tablet, sender and recipient not preserved.

(19-24) Furthermore, because there is a food shortage in the land, up in the city *Kašepura*, let them conduct him .... And let them proceed to take seed? grain?, and carry it up to the city, and let them prepare much *tumati*-bread for it. (Hoffner 2009: 171-173).

A second group of letters here selected includes HKM53, HKM 54, HKM 55, HMK 66, HKM 68 (tentative), and HKM 84 (Hoffner 2009). This dossier is centered on the correspondence between the frontier post governor (Kaššu) and the Chief of the Army Inspectors (Ḫimmuili.). The central topic is the availability of grain-seeds. Kaššu directly accuses Ḫimuili of having taken the seeds that were destined to *Tapikka*, *Kašepura*, and other towns (HKM 55). Kaššu furthermore argue that Ḫimmuili used for agricultural work (plowing) the cattle from *Kašepura*, without having the due authorization to do so (HKM 54).

HKM 54: From Kaššu to Ḫimmuili.

(1-3)Thus speaks Kaššu: Say to Ḫimmuili: (4- 7)Concerning what you wrote me about seed: "There is no seed for the plowed fields." (8-17)Shouldn't you have taken from there the barley and wheat which was intended for sowing (for) *Tapikka*, *Anziliya*, *Ḫariya*, and also *Ḫaninkawa*? Then they could have sown those plowed fields. (18-24)Regarding the fields that you plowed with the cattle of *Kašipura*, will it not result in their questioning you on that matter from the (regional) palace? (25-28)Now take from there and sow those seeds. And don't withhold (literally, 'cut off') my messengers from me. (Hoffner 2009: 198-200).

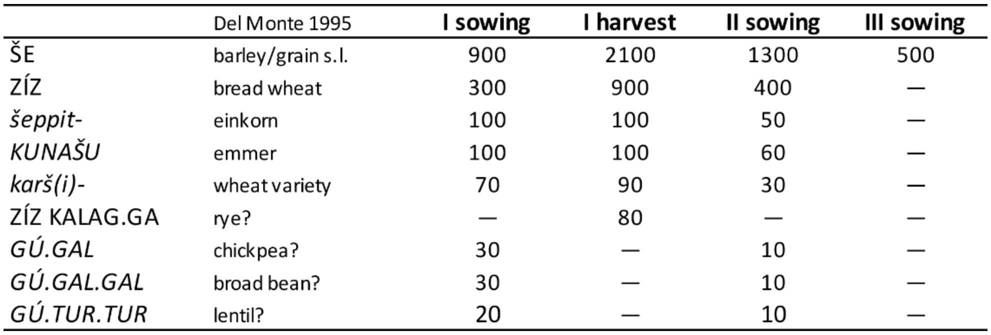
HKM 55: From Kaššu to Ḫimmuili

(1-2)Thus speaks Kaššu: Say to Ḫimmuili: (3-9)Pulli has just written me from *Kašepura*: "As for the (plowed) fields of *Tapikka* and *Taḫašara* which were plowed, Ḫimmuili doesn't give seed (for them). There is no seed." (10-17)Where did those seeds go, about which you spoke to me, Ḫimmuili, (saying): "These are sown in *Tapikka*, these in *Anziliya*, these in *Ḫariya*, and these in *Ḫanikkawa*"? (18-22)... Ḫimmuili ... when you do not hasten, you will not sow it. (23-28)When you expedite the lords' sowing for us, you will keep sowing the lords' seeds. But you say "no" to the sowing of seeds of the palace. (29-35) Why are you (pl.) not sending my messengers (back) to me? Are your servants too tired (to do so)? Do the(se) messengers not belong to our lord? Even the land (itself) belongs to our lord. If only you (sg.) would keep writing me everything about how it is there! (36-40) Because you, Ḫuilli, were with His Majesty, did you speak of me ... before His Majesty? ... was in the land. Send it out. May His Majesty, My Lord, know about you! He treated (you) well. Didn't he treat you well in regard to the work gangs ... ?. (Hoffner 2009: 200-203).

In addition to letters, the archive from Maşat Höyük includes a small group (17 tablets) of administrative documents (del Monte 1995). Regardless of the limited number of texts, these tables are extremely interesting for our purposes, given the paucity of this type of documents in the Hittite corpus. Leaving to the work of del Monte (1995) a detailed analysis of this group of texts, in this section, I will briefly discuss the so-called Agricultural texts: HKM 109, HKM 110, and HKM 111, focusing in particular on HKM109.

HKM 109 and HKM 110 are to date a unicum in the Hittite corpus. HKM 110 is extremely fragmentary, we will thus discuss here only HKM 109. The two texts are interpreted (del Monte 1995, Hoffner 2001, d'Alfonso and Matessi 2021) as the forecast of sowing and harvesting over a three-year agricultural cycle at the locality of *Kašaša*, to be located in the surroundings of *Tapikka*. The text is structures as follows: (*i*) first year – the quantity of grain-seeds to be used in the first year is given, which is followed by the expected harvest. After the data on cereal yields, it is reported the quantity of pulses to be sown in the first year; (*ii*) second year – it is provided the quantity of cereals and legumes that are to be sown in the second year, harvest data are not provided; (*iii*) third year – it is given the quantity of cereals to be sown in the third year, pulses are not mentioned (del Monte 1995: 122-123). The information contained in HKM 109 are summarized in Table 2.12.

I am echoing Del Monte (1995: 128-19) in stressing that a cautious approach is needed when evaluating the values reported in HKM 109, considering the complexity of the text and its unique nature within the Hittite corpus. If, nevertheless, we were to reconstruct seeding multiplication ratios (sown/harvested seeds), the values obtained for the first year of the agricultural cycle would have comprised between 1:2 and 1:3. A return of two grains for each one that is sown is on the border of what most farmers would consider a harvest failure, considering that such low yields would hardly replenish the resources needed to grow them (labor, animal feeding, etc.). It is, thus, to be assumed that those numbers are an indication of a net yield – in which a significant (unreported) amount of harvest has already been deducted – or extremely conservative.



	Del Monte 1995	**I sowing**	**I harvest**	**II sowing**	**III sowing**
ŠE	barley/grain s.l.	900	2100	1300	500
ZÍZ	bread wheat	300	900	400	—
šeppit-	einkorn	100	100	50	—
KUNAŠU	emmer	100	100	60	—
karš(i)-	wheat variety	70	90	30	—
ZÍZ KALAG.GA	rye?	—	80	—	—
GÚ.GAL	chickpea?	30	—	10	—
GÚ.GAL.GAL	broad bean?	30	—	10	—
GÚ.TUR.TUR	lentil?	20	—	10	—

Table 2.12 – *Sowing and harvest previsions reported in* HKM 109. The translation of the cereal and pulse names follows del Monte 1995 and it is to be regarded as tentative. Quantities are given in “parisu”.

It has been already noted that pulses in the section of the tablets covering the first year are listed after the cereal harvest. Marazzi (2008: 77-79) argued that it could be interpreted as evidence of late sowing of pulses, after that the cereals were already harvested. Together with the limited quantity of cereal sown in the last year covered by the tabled, this consideration led the author to speculate on the presence of a three-year rotation systems, which included some forms of pulses/cereals alternation and fallowing (Marazzi 2008: 79). Del Monte (1995: 127) pointed out that the cereal named ZÍZ KALAG.GA is listed in the harvest, in moderate quantities, but yet it does not figure among the grains that are sown. This observation, according to the author, could indicate that this cereal was growing spontaneously together with the main crops, a fact that led del Monte to propose and identification of ZÍZ KALAG.GA as rye, which is known to occur as ‘tolerated’ weed in wheat fields.

- *Selected sources: local cults and agricultural production*

Agricultural activities played a central role within the complex religious calendar of Hittite Anatolia. The rich corpus of texts informing on this aspect of the Hittite culture, can thus provide important information also on agricultural and rural life. This topic has been recently discussed by Cammarosano (2018) as part of a broader analysis of Hittite, non-state, local cults: recurrent religious festivals occurring outside the capital of *Ḫattuša* in the provincial towns and villages of the core area of the Hittite kingdom and that, in contrast to state cults, were inclusive of large sectors of the population (Cammarosano 2018). The main source on these festivals is represented by the so-called "cult inventories", which are reports on cultic activities compiled by the central administration (Cammarosano 2018: 15). In addition to local cult, states festivals provide further insights on the Hittite agricultural system, which I will not discuss here because of space and time constrains.

The autumn and spring festivals are at the core of the Hittite religious calendar. According to Cammarosano (2018: 106) these two festivals were celebrated in every Hittite or Luwian settlement. The connection of these two festivals with the agricultural cycle is explicit: the autumn festival is associated to cereal sowing, the spring festival to the harvest. A pivotal aspect in both festivals is the ritual of the manipulation of the storage pithos ($^{\mathrm{DUG}}$ḫarši, $^{\mathrm{DUG}}$ḫaršiyalli): during the autumn festival, the vessel was filled with grains; in the spring festival, the pithos was ritually opened, and bread loaves were prepared using the grains therein stored. Cammarsano (2018: 116) proposed that both actions are to be understood with a well-defined symbolic and propitiatory value: the filling of the pithos symbolically stands for the seeding, while the opening is propitiatory of the growth of the cereal plants and the success of the forthcoming harvest. This latter aspect is well exemplified by the invocation which concludes the spring festival of the Storm God of the Rain in Ḫakmiš, which is worth quoting in full:

> "When in spring it thunders, they open the pithos, and grind! (and) mill! it(s content). (The priest) of[fers] 1 sheep to the Storm God of the Rain. They place the meat (there), raw (and) cooked. Loaves of bread of the pith[os, *n* vessels of beer] at the altar; 30 loaves of one handful (of flour), 3 vessels of beer (are) the provisions. They br[eak] loaves of bread, fill the BIBRU-vessels, eat (and) drink, pr[ovide] the cups. They pour 1 bowl of beer, in its entirety, on the ground, and speak concurrently: "O Storm God, my lord, make rain plentiful! And make the dark earth satiated! And, O Storm God, let the loaves of bread become plentiful!" (KUB 25.23+ rev. iv 51'-59') (Cammarosano 2018: 375 and text no.13).

The celebration of the spring festival occurred simultaneous to the beginning of the spring rainfall: "*When spring comes* (*and*) *it thunders, they break open the pithos*" is the recurrent formula denoting the beginning of the spring and the celebration of the festival (Cammarosano 2018: 39). It is hardly a coincidence, I believe, that this ritual propitiatory for the harvest occurred in concomitance to the beginning of the peak in spring precipitation: the available moisture during the spring growing and earing period is known to be strongly correlated to the number of grains that reach maturation in each plant (e.g., Sen et al. 2012). In this text, this association between spring rains and harvest (symbolized by 'loaves of bread') is explicitly made in the closing invocation: "make rain plentiful! And make the dark earth satiated! And, O Storm God, let the loaves of bread become plentiful".

In addition to pithoi manipulation, both festivals included a procession, during which the cult statuettes of the deities were brought from the urban to the extramural sanctuary. In this occasion, ritual offering, feast, athletic games, and “manifestations of joy” were taking place (Cammarosano 2018: 115-129). Local non-state festivals, according to Cammarosano (2018: 103-110) involved a large portion (or even all) of a local community. Thus, possibly functioning as catalyst for labor mobilization in concomitance to the main works defining the agricultural calendar.

Several other local festivals of clear agricultural character are documented in the cult inventories, including the “festival of the harvest” (BURU$_{14}$), the “festival of making the sickle” ($^{\text{URUDU}}$ŠU.KIN DÙ) the “festival of releasing the sickle” ($^{\text{URUDU}}$ŠU.KIN *tarnummaš*), the “festival of the grain pile” (EZEN$_{4}$ *šeliyaš*), the “festival of the vine” (*ippiyaš*), the “festival of the cutting of the vine” ($^{\text{GIŠ}}$GEŠTIN *tuḫšūwaš*) and the “festival of the fruit” (GURUN) (Cammarosano 2018: 108-110).

- *Selected sources: epistolary evidence of grains shortages and deliveries*

The last group of Hittite sources selected for this overview concern the evidence of food shortages in the final decades of the Hittite Empire, a topic that has been first explored by Horst Klengel (1974). More recently, Singer (1999), Divon (2008), Halayqa (2010), and Knapp and Manning (2016) reviewed the available textual evidence, which mainly consists of letters found in the Boğazköy-*Ḫattuša* and Ras Shamra-*Ugarit* archives, dated between the mid-13th century and the end of the Empire (ca. 1180 BCE), concerning shipments of large quantities of grain, often framed in dramatic tones.

The earliest evidence of these grain requests are two letters dated to the reign of Hattusili III, found in Boğazköy as part of the intense diplomatic correspondence between the Hittite and the Egyptian courts, preceding and following the ‘eternal treaty’ between the two Late Bronze Age powers (tentatively, 1259 BCE — see Bryce 2006). In CTH 176 (Edel 1994 I: 216-217), the Hittite queen Puduḫepa writes to Ramesses II, asking the pharaoh to hurry in sending the due dowry, because, she says, "*I have no grain in my land*." In a second letter, CTH 163 (Edel 1994 I: 182-184), sent by Ramesses II to Hattusili III, the organization of a Hittite expedition to Egypt with the goal of obtaining barley and wheat is mentioned. Remarkably, in the same letter it is reported that the pharaoh sent three Egyptian experts in "*administration of water-drawing*" to Hatti. The shipment of grains from Egypt to Hatti also continues under the son and successor of Ramesses II, the pharaoh Merneptah. In his celebratory inscriptions (the Merneptah stele; Kitchen 1982: 5.3) the pharaoh claims how he "*caused grains to be taken in ships, to keep alive the land of Hatti*." To this well-known evidence, we should add a recently published letter from Ugarit (RS 94.2002+2003; Lackenbacher and Malbran-Labat 2016: 81-87), mentioning a shipment of grain organized by Merneptah to relieve a famine in Ugarit itself.

The harbor-cities along the Levantine and Cilician coasts played a crucial role in conducting and facilitating these shipments between Egypt and Anatolia. If the role of the Cilician port of Ura (Silifke?) can be only indirectly appreciated, being that the ancient site is archaeologically unknown, the importance of Ugarit is well documented in the textual record. Indeed, the epistolary evidence shows the involvement of Ugarit in purchasing grains in Canaan (Tel Aphek - No. 52055/1; Owen 1981) and Egypt (e.g., RS 18.031), as well as — following Hittite orders — moving grains from the Levantine coast to Ura (e.g. RS 20.212 and RS 26.158). The emergency nature of these shipments is suitably exemplified in RS 20.212: "(it is matter) of death (or) life" (Singer 1999: 715-719). By the end of the 13th century (reign of Šuppiluliuma II) it appears that Ugarit was increasingly solicited by Hatti to deliver grains (Halayqa 2010: 302-303).

It is possible that these grain shortages were not limited to the Anatolian Plateau, but also the Levantine coast and its interior might have been severely affected. In this regard, to the already quoted RS 94.2002+2003, we can add at least two other documents found in Ugarit: in RS 18.038 the Ugaritic king Ammurapi claims that there is no grain in his country (Singer 1999: 717), while in RS 34.152 an unknown addresser claims that there is no food left in his land and, therefore, everyone is starving (Singer 1999: 719). Against this background we might also consider a series of letters from Ugarit in which Uriyanni-officials repeatedly request the delivery of resources (workers and animals) from Ugarit to be employed for irrigation works at Alalakh (RS 94.2509; Lackenbacher and Malbran-Labat 2016: 64-65). The same officials were involved in shipments of grain supplies to Hatti (RS 94.2585; Lackenbacher and Malbran-Labat 2016: 59-60). I will return on this topic in Chapter 7.

2.3.3 *Agriculture in the Iron Age Anatolian hieroglyphic corpus*

The collapse of the Hittite Empire, ca. 1180 BCE, corresponds in Anatolia to the complete disappearance of the cuneiform writing system (Section 1.2.4). Local textual sources available for the Iron Age are, thus, limited to the Anatolian hieroglyphic corpus (Hawkins 2000) and, in a more limited extend, alphabetic inscriptions. The distribution of Anatolian hieroglyphic is limited to the former southern and southeastern peripheries of the Hittite Empire, with clusters at Aleppo, Amuq, Cilicia, Hama, Karkemis, Kummuh, Malatya, Maraš, Tell Ahmar, and Tabal (Hawkins 2000) (Figure 1.13). Further information on the historical and political context of Iron Age Anatolia, I refer the interested reader to Section 1.2.4.

The Iron Age Anatolian hieroglyphic corpus is overwhelmingly composed by texts redacted by kings, petty kings, and vassals, having a scope explicitly celebratory and propagandistic. With only single exceptions, most notably the so-called KULULU lead strips, this corpus does not contain texts of administrative nature. The use of these sources in order to reconstruct agricultural production, and more in general the local and regional economic history, is consequently particularly challenging. Yet, as shown by Giusfredi (2010) some important information on these topics could be extrapolated. In the following paragraphs, I will first introduce to the main terms indicating agricultural products in the hieroglyphic corpus, for then discussing the main agricultural topoi therein attested. In a specific section, finally, I will discuss the so-called KULULU strips.

- *Agricultural products in Anatolian hieroglyphic*

Anatolian hieroglyphic poses several transliteration and translation issues, due to the nature of the script and the comparatively limited extension of the corpus (e.g., Marazzi 1990). Leaving aside references to livestock, which are outside the scope of this project, the two main agricultural products documented in these sources are "barley", tentatively translated from the logographic sign *179 (Marazzi 1990: 158-159), and wine – which is indicated by the logogram *160 and associated syllabic terms (Marazzi 1990: 152-153, and references therein).

On the basis of contextual information, there is general agreement regarding the recognition of sign *179 as a logogram indicating a cereal grain. A more specific identification as barley has been proposed by Hawkins (1986: 93), based on this product being often referred to as a good of common exchange, which according to the author in the western Asian context favors the identification as barley. This translation is commonly reported in the literature (e.g., Marazzi 1990: 158-159, Hawkins

2000: 469); although, it cannot be a priory excluded that it indicated also other cereals.

The identification of sign *160 as a logographic for “wine” is based on the frequent co-occurrence of this sign with syllabic Luwian terms directly associated to the spere of viticulture, such as: *wiyani*-, "vine"; *matu*-, "wine"; *tuwarsa*-, "vineyard"; *tipariya*-, "wine-god"; and *sarlata*-, "libation" (Marazzi 1990: 152-153). The identification of this sign as indicating grapevine-related terms is, accordingly, comparatively straightforward. When sign*160 is not coupled with a second syllabic term, its interpretation is more challenging – as discussed by Hawkins for the KARATEPE 1 bilingual inscription (Hawkins 2000: 64).

A discussion of the unit of measures utilized in the Iron Age hieroglyphic corpus is provided by Giusfredi (2010: 177-180, and references therein). It has been noted that the presence of two, geographically distinct, unit systems: the *tiwatali*- unit, in southcentral Anatolia; and sign *100 (ASINUS), in northern Syria. The *tiwatali*- unit is attested in the inscriptions of AKSARAY (Hawkins 2000: 475-478), BOR (Hawkins 2000: 518-522), and SULTANHAN (Hawkins 2000: 463-472). This unit is, thus, to date attested only in the region of Tabal. The *tiwatali*- is used in order to measure both dry (“barley”; S AKSARAY, ULTANHAN, BOR?) and liquid (“wine”; AKSARAY, BOR, SULTANHAN) products, it could be accordingly very reasonably considered to refer to a unit of volume. As noted by Hawkins (1986: 98) this unit hardly fit the Assyrian measure systems. It remains, however, problematic to quantify an equivalent of this unit in a known system (Giusfredi 2010: 177-180). The *tiwatali*- system does not occurs outside Tabal. In North Syria a second unit of capacity seems to have been in use, which is indicated by the sign *100 – transliterated as ASINUS (Marazzi 1990: 134-135). The syllabic reading of this sign remains to date unknown (Giusfredi 2010: 177-180).

Information on prices of agricultural products is provided in a handful of inscriptions (AKSARAY, SULTAHAN, KARKAMIŠ A2, and possibly BOR), as part of the self-celebratory rhetoric proper of these texts (Giusfredi 2010: 177-180). These prices are, surely, to be considered as poorly indicative of the actual economy, but rather to be part of a propagandistic image of an 'ideal' economy promoted by the local Siro-Anatolian rulers (Hawkins 1986). In the following paragraph, the most significant passage informing in these regards are reported – following Hawkins (2000) edition and translation:

> "[... Tarjhunzas prospered the NISA, and m[uch] came down from the sky, and much came up from the earth, and in those years for one sheep 30 measures (of) barley stood, 20 measures (of) oil (?) [...]ed, [...] measures (of) wine stood. ..." (AKSARAY; Hawkins 2000: 476).
>
> "And Tarhunzas of the Vineyard gave [to] Wasusarmas, [... ki]ng, a mighty courage, and for him he put his enemies under his feet. When I set him up, and when in the land 2 sheep stood (for) 80 (measures of) barley, afterwards I presented him with a TAWANI-bird here. So Tarhunzas made these assistances for Sarwatiwaras Wasusarmas's servant, and WASUNATA(P) will come down *much*(?) from the sky, and the *corn-stem*(s) will come up from the earth, and the vine." (SULTANHAN; Hawkins 2000: 476).
>
> "In my good times for a sheep ten homers (of barley) stood, and I myself thereupon constructed(?) these temples of Tarhunzas for him with goodness" (KARKAMIŠ A2; Hawkins 2000: 109).

In all instances, prices are given in terms of equivalent to the value of a sheep: which corresponds to 30 *tiwatali*-measures of barley at AKSARAY, 40 *tiwatali*-measures of barley at SULTANHAN, and 10 ASINUS-measures of barley at KARKAMIŠ A2.

In addition to price lists, agricultural topoi figure comparatively commonly in the Iron Age Anatolian hieroglyphic epigraphic corpus, as part of a broader rhetoric centered on the topos of abundance and the idealized figure of the "good ruler" (e.g., Masetti-Rouault 2004). In the following section, I will further expand on this topic, by discussing the epigraphic evidence of large-scale storage.

- Iron Age epigraphic evidence of large-scale storage

Granaries are, relatively speaking, well attested in the Iron Age hieroglyphic Anatolian corpus (van den Hout 2010, Simon 2011, Balza 2017), in which are reported by the Luwian word *karuna/kaluna* associated with the determinative sign *255/*256 (van den Hout 2010). In the following paragraphs I briefly summarize this evidence in translation, following a tentative chronological order. The edition, transliteration, and translation provided is from Hawkins 2000.

1. KARKAMIŠ A30h (Hawkins 2000: 177-178. CHLI II.42), inscription of archaic (12th – 11th century BCE) or archaizing (10th – 9th century BCE) date, mentioning the filling of a granary dedicated to Kubaba.[8]

> §1-3 No one used to fill Kubaba's (?) granary, (but) she/they ...-ed me House-Lord, (and) I filled it with 3000 (measures of) cereal(?) (and) with 4000 (measure of) wine (...).

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[8] On a palaeographic basis, an Archaic dating was proposed by Meriggi (IIIa serie) and Laroche (1200-1000 BCE), while Hawkins (2000: 177) proposed an archaizing dating.

2. MARAŞ 8 (Hawkins 2000: 252-255. CHLI IV.1), tentatively dated to the first half of the 10th century BCE. The local ruler, Laramas son of Muwatali, celebrates the planting of vineyards and the filling of granaries.

§6-7 (…) *For the city I planted out … vineyards*(*?*)*, I filled granary on*(*?*) *granary* (…).

3. TELL AHMAR 5 (Hawkins 2000: 231-234. CHLI III.3), tentatively dated to the late 10th – early 9th century BCE. The local ruler, Hamiyatas, recalls the dedication of granaries to the Storm God of Aleppo by his father, and puts those structures under a protective curse.

> §1-18 *I* (*am*) *Hamiyatas* […*?*]*, Masuwarean king. These granaries my father filled* (*with*) *… barley, and over* (*them*) *he set this Halabean Tarhunzas, and he "made* (*them*) *run" after this* (*one*) (*?*)*. These granaries* (*he*) *who* […] *But when my father died, the WARALI's extended this god to the lower river* (*??*)*. But thereafter this god exalted me, and to me his spokesman said: "*[…] *cause to exalt high … person* […*"* …] *person I caused to exalt.* (*He*) *who shall overturn these granaries, or who shall come for Hamiyatas* [*with* (*?*)] *badness,* […

4. HAMA 8 (Hawkins 2000: 409-410. CHLI IX.6), tentatively dated to the mid-9th century BCE. The local king, Urhilina, celebrates the construction or filling of a granary.

§1-2 *I* (*am*) *Urhilina, Paritas's son, Hemathite king. This granary I myself for Ba'alatis …*

5. İSKENDERUN (Hawkins 2000: 259-261. CHLI IV.3), possibly dated to the late 9th century BCE. The local king, Lamas, dedicates a granary through a grinding-stone shaped stele.

§1-4 *I provided*(*?*) *it* (*as*) *a millstone*(*?*) *and because it/they became available to me, I brought*

> *this granary, and into it I brought four thousand four hundred, with this zipatani-measure.*

6. KARATEPE 1 (Hawkins 2000: 45-68. CHLI I.1), in the Luwian-Phoenician bilingual, dated to the turn of the 8th century BCE, it is mentioned the filling of a granary.

> §30-48 (...) *and in my days there were to Adanawa all good things, plenty and luxury, and I filled the Paharean granaries, and I made horse upon horse, and I made army upon army* (...).

The translation of *255/*256 *karuna/kaluna* as granary was proposed by Marazzi (1998: 103, n3) and more recently sustained by van den Hout (2010), who suggested to further narrow down the meaning of the term to an underground granary. If the term is explicitly connected with cereals only in the case of TELL AHMAR 5 (logographic HORDEUM), its association with grains is hypothesized in all the other instances on a contextual basis. As noted by van den Hout (2010: 234), the term is frequently associated (KARATEPE, KARKAMIŠ A30h, AHMAR 5, MARAŞ 8) with the verb 'to fill' (*suwa-/susu-*). Hence, *255/*256 *karuna/kaluna* describes something to be filled (likely) with cereals. An estimation of the capacities of these structures on the basis of the available textual evidence remains problematic. In KARKAMIŠ A30h the unit of measure is not specified, while at İSKENDERUN the "*four thousand four hundred ... zipatani-measure*" are hardly quantifiable due to the unclear interpretation of this unit. In addition, because of the self-celebrative character of these texts, exaggerations and figurative expressions are expected – as it is likely the case of the conduplicatio in "*four thousand four hundred* (...) *zipatani-measure*". Despite these limits, it remains clear that in the textual record it is stressed the large dimension of these structures. Finally, an additional piece of information comes from TELL AHMAR 5, in which a long-lasting lifespan of these structures is suggested by mentioning 'granaries' that are in function for more than one generation. To sum up, we are considering structures/things that were lasting several years and were filled with significant quantities of grains. Hence, it is reasonable to recognize in these items some sort of storage facilities.

On a general level, cereal storage was conducted through three main types of structures: in bag or vessel storage, underground, and aboveground granaries (FAO 2011). Those three types are all potentially consistent with the general semantic value of *255/*256 *karuna*/*kaluna* – i.e., a structure/thing filled with cereals. I reject the possibility that the term refers to vessels or bags basis on their frequent dedication to deities (KARKAMIŠ A30h, HAMA 8, TELL AHMAR 5), protection through curses (TELL AHMAR 5), their capacity clearly exceeding a single container (KARKAMIŠ A30h, İSKENDERUN), and a lifespan lasting more than a single generation (TELL AHMAR 5) – strongly suggesting the presence of some sort of architecture. In order to further circumscribe the type of structure indicated by the term, important insights could be found in the determinative sign *255/*256 itself. As noted by van den Hout (2010: 237), the sign – a square with a smaller circle (*255) or another square (*256) in the center – might render a zenithal view of an underground silo-pit with a central draining hole, closely recalling archaeological examples from Late Bronze Age Boğazköy (Seeher 2000: 270-278). To conclude, and confirming previous research, it appears possible to identify *255/*256 *karuna*/*kaluna*, attested in the Iron Age hieroglyphic Anatolian corpus as a term defining, at least in its general meaning, as underground granaries under the control of the central institutions. Centralized storage appears, accordingly, to have represented a central topic in the rhetoric of Iron Age Siro-Anatolian polities – as I will further discuss in Section 4.3.

- *The KULULU lead strips*

Although the overwhelming majority of Iron Age hieroglyphic Anatolian records are engraved on stone (outcrops, stele, or orthostats), single finds attest the use of hieroglyphic writing on lead strips. This latter practice documents the existence of an administrative (KULULU lead strips; Hawkins 2000: 503-513) and private (ASSUR letters; Hawkins 2000: 533-555) use of the Anatolian hieroglyphic, which is otherwise not attested in the corpus. Of direct relevance for the scope of this dissertation are the se-called KULULU lead strips, which I will briefly discuss in the following paragraphs. In addition to the main edition of Hawkins (2000: 503-513), this evidence is discussed at length by Gisufredi (2010: 182-207).

The archaeological context of the KULULU lead strips is unknown: they were discovered by a private individual and sold to the Ankara Museum in 1967 (Hawkins 2000: 503). The strips allegedly originated from the village of Kululu, located ca. 75 km to the northeast of Kayseri. The specific provenience of these finds has been, however, questioned, considering it more likely that they originated from illicit excavations in the region of Kayseri (Giusfredi 2010: 185). This small corpus consists of two entire (strip 1 and strip 2), one joined (strip 3 + fragment 2), and two fragments (fragment 1 and fragment 3) lead strips inscribed in Anatolian hieroglyphic (Hawkins 2000: 503, Giusfredi 2010: 185). KULULU Lead Strip 1 is interpreted as a registration of incoming and outgoing quantities of barley (sign *179); the Lead Strip 2 is structurally very similar to the Strip 1, although referring to sheep rather than grains; the Lead Strip 3 + Fragment 2 is interpreted as a census list; finally, the remaining two fragments (1 and 3) are considered too fragmentary to allow any interpretation (Giusfredi 2010: 182-207). The KULULU Lead Strip 1 translates as follow:

"Of the town [Tiw]arali 400 (measures of) barley ... from Ar(a)hwitas(?)
100 (measures of) barley from Hapiyamis [x]rusa/is' (son), of the town Huwa/i.
100 (measures of) barley from Uramuwas, of Uramuwas' town.
100 (measures of) barley from Kwisais (?), of Urarnuwas' town.
100 (measures of) barley from Mur(a)kis.
30 (measures of) barley from Nus, of Uramuwas' town. Of the town Upper Tuna: 140 (measures of) barley from Hapira/is.
120 (measures of) barley from Kulis.
100 (measures of) barley from Tas, the cup-bearer(?).
100 (measures of) barley from Tarhunazas, the freeman374 .
50 (measures of) barley from Huliyas Kukuwa/is' (son), of the town Tuna.
..." (Giufredi 2010: 192).

Given the repetitive nature of the text, only a sample has been reported in quotation. The text consists in a long list of quantities of grain (barley, according to the standard translation of sign *179) which were either received or assigned to different individuals, which towns of origin and, in some instances, profession is given. The unit referred by these quantities is not specified, according to Giusfredi (2010: 198) it can be reasonably hypothesized that it was in use the *tiwatali-* measure, which is attested elsewhere in the Anatolian Plateau (Tabal). According to the quantities reported, this text is considered to belong to a public administration rather than a private archive, possibly part of a tax record (Giusfredi 2010: 198).

For the scope of this chapter, the KULULU strips provide the opportunity to emphasize the presence of administrative sources involving staple products, a bookkeeping tradition which is otherwise strongly underrepresented in the documentary record from central Anatolia.

2.3.4 *Greco-Roman sources on ancient central Anatolian agriculture*

The last period that I am including in this dissertation is covered by sources originating from Graeco-Roman authors. In this section, I will first provide a brief discuss about the available evidence for agriculture during the Achaemenid period, from there, I present more in-depth information on Anatolian agriculture available in Strabo's *Geography*. Because of space and time limits, the following sections concentrate exclusively on the Anatolian Plateau, without delving into the far richer textual documentation concerning western Anatolia, the Aegean Coast, and the Pontic region. Roman Imperial and Late Antique sources are, likewise, not reviewed. For the latter, I refer in particular to the overview provided by Izdebski (2013, and references therein)

- *Agricultural production and tributes in Achaemenid Anatolia*

Our knowledge of Achaemenid Anatolia is extremely limited, due to a paucity of textual and archaeological evidence (Section 1.2.5). Greek sources are mostly concerned with the western satrapies of Asia Minor, which were more directly involved in the Aegean political history (Dusinberre 2015: 35). Very little information is, on the other hand, available for the satrapies of Cappadocia and Greater Phrygia, in central Anatolian (Dusinberre 2015: 35). Within this general context, textual sources are completely silent in regard to central Anatolian agriculture during the Achaemenid period. The sole considerations that I can make are, thus, informed by a more general understanding of the administrative structure of the Persian Empire, especially in relation to the topics of taxation and land tenure regime.

A general review of the Achaemenid taxation system is provided by Kleber (2015, and references therein). In the provincial organization of the Achaemenid Empire, the satrap was responsible for maintaining the order in his province and to guarantee the payment of the tribute to Susa. According to Strabo, in addition to the silver tax, the Cappadocian satrapy paid a tribute of 1,500 horses, 2,000 mules, and 50,000 sheep (Strabo, Geography: 11.14.9). In the Apadana reliefs, at Persepolis, the IX delegation, which is commonly identified as Cappadocian, is represented bringing a tribute of horses and textiles (Roaf 1983: 53-54).

Scholars believe that provincial capitals hosted archives where tax records and other administrative documents were recorded. Although, to date such archives are not known in Asia Minor, their presence could be inferred by bullae and seals found at the provincial centers of *Dascylium* (Hellespontine Phryigia), *Gordion* (Greater Phrygia), and *Sardis* (Lydia) (Keplan 2002). Impressions on the bullae found at *Dascylium* suggests that administrative documents were produced on perishable supports, such as papyrus and parchment (Keplan 2002).

- *The agricultural landscape of central Anatolia in Strabo's Geography*

Strabo (64/63 BCE – 24 CE) represents the main source on Anatolian economy in the Hellenistic and Roman period. The Greek geographer, philosopher, and historian was native of *Amaseia* (Lindsay 2009), in the Pontic region of Asia Minor. It is, thus, far from surprising that the Anatolian Peninsula is well-discussed in the *Geographica*, which features in seven books: Book VII (Bosporus), Book XI (northeastern Anatolia), Book XII (Central Anatolia, Pontus, western Anatolia), Books XIII and XIV (Southern and Western Anatolia), and finally Book XVI (Southeastern Anatolia) (Roller 2014).

Book XII is regarded as one of the most detailed geographic accounts provided by Strabo, suggesting that he directly visited the region and he had access to firsthand information (e.g., Panichi 2009). This book is divided into 8 chapters, respectively covering: Cappadocia (XII.1-2), Paphlagonia and Pontus (XII.3), Bithynia (XII.4), Galatia (XII.5), Lycaonia (XII.6), Pisidia (XII.7), and Mysia and Phrygia (XII.8). For the location of these regional historical toponyms, I refer the reader to Figure 1.14. A brief overview on the Hellenistic historic context of central Anatolia is provided in Section 1.2.6.

In the following paragraphs I will concentrate on the chapters in Book XII that cover the central Anatolian regions, outlining the main information on local agricultural economy therein present. For a more detailed analysis of the rich historical geography discussed in this volume, I recommend reading Sofou (2005) and to the geographic commentary provided by Roller (2018). The edition and translations provided in the following paragraphs are from Jones 1917.

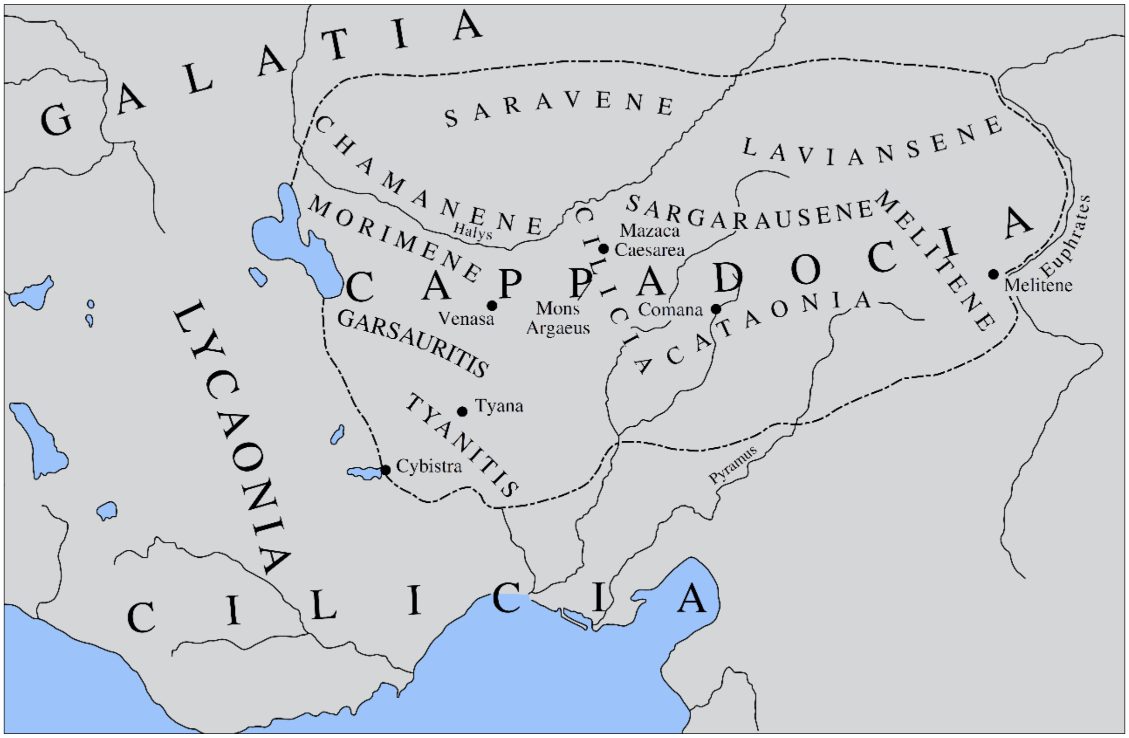

GALATIA
SARAVENE
CHAMANENE
LAVIANSENE
MORIMENE
Halys
SARGARAUSENE
Mazaca
Caesarea
CILICIA
MELITENE
Euphrates
Melitene
CAPPADOCIA
Venasa
Mons
Argaeus
Comana
CATAONIA
GARSAURITIS
LYCAONIA
Tyana
TYANITIS
Cybistra
Pyramus
CILICIA

Figure 2.12 – The districts of Cappadocia according to Strabo's Geography. Redrawn from Panichi 2009.

The first two chapters of Book XII concentrates on Cappadocia. Before moving any further into this overview, I should clarify the geographic meaning of this term. The Achaemenid satrapy of *Katpatuka*, named by the Greeks as *Kappadocia*, covered a large portion of central Anatolia, extending from the Taurus Mountains to the Black Sea coast (Strabo, Geography: 12.1-2). The satrapy of Cappadocia, thus, originally covered an area far larger than what it became in the Hellenistic Kingdom of Cappadocia. In Strabo's account, *Kappadocia* was extending from the Euxine Pontus to the north and the Taurus chain to the south; to the east, the region was bordered by Armenia and the Colchis, while to the west by Galatia and Lycaonia (Strabo, Geography: 12.1-2) (Figure 1.14 and 2.12). According to Strabo, Cappadocia was divided into ten districts: *Melitenê*, *Cataonia*, *Cilicia* (not to be confused with *Cilicia Pedias*, in the Çukurova Plain), *Tyanitis*, *Garsauritis* – which were located near the taurus; and *Laviansenê*, *Sarganausenê*, *Saravenê*, *Chamanenê*, and *Morimenê* – which were located more to the north (Figure 2.12). According to Strabo, an eleventh prefecture was added at a later stage.

On Strabo's acount, central Anatolia was characterized by productive agropastoral economies, which were focused on cattle breeding and cereal farming. Arboriculture, on the contrary, appears to have been a specialization which was limited to specific districts within the Plateau. Quoting from the author:

> "The size of the country is as follows: In breadth, from Pontus to the Taurus, about one thousand eight hundred stadia, and in length, from Lycaonia and Phrygia to the Euphrates towards the east and Armenia, about three thousand. It is an excellent country, not only in respect to fruits, but particularly in respect to grain and all kinds of cattle. Although it lies farther south than Pontus, it is colder. Bagadania [an isolated plain south of Mazaka-*Kayseri*

> (Roller 2018: 692)], though level and farthest south of all (for it lies at the foot of the Taurus), produces hardly any fruit-bearing trees, although it is grazed by wild asses, both it and the greater part of the rest of the country, and particularly that round Garsauira and Lycaonia and Morimenê" (Strabo, Geography: XII.2.10).

A First point that emerges in Strabo's account of central Anatolian economies is, thus, concerning the presence of local specialization in agropastoral activities. In order to further emphasize this point, I quote the passages describing *Melitenê*, in the region of Malatya in the Upper Euphrates Valley, Malatia and *Mazaka*, which corresponds to the modern city of Kayseri:

> "Melitenê is similar to Commagenê, for the whole of it is planted with fruit-trees, the only country in all Cappadocia of which this is true, so that it produces, not only the olive, but also the Monarite wine, which rivals the Greek wines" (Strabo, Geography: XII.2.1).

> "Further, the districts all round [Mazaka] are utterly barren and untilled, although they are level; but they are sandy and are rocky underneath. And, proceeding a little farther on, one comes to plains extending over many stadia that are volcanic and full of fire-pits; and therefore the necessaries of life must be brought from a distance. (Strabo, Geography: XII.2.7). ... However, although the district of the Mazaceni is in many respects not naturally suitable for habitation, the kings seem to have preferred it, because of all places in the country this was nearest to the centre of the region which contained timber and stone for buildings, and at the same time provender, of which, being cattle-breeders, they needed a very large quantity, for in a way the city was for them a camp" (Strabo, Geography: XII.2.9).

In addition to *Melitenê*-Malatya, other rich agricultural regions in Strabo's account are *Cataonia* ("a broad hollow plain, and produces everything except evergreen-trees"; Strabo, Geography: XII.2.2); the territory of Venasa, in the district of Morimenê ("a sacred territory that is very productive", Strabo, Geography: XII.2.6); and the Tyanitis ("its territory is for the most part fertile and level"; Strabo, Geography: XII.2.7).

In his description of Cappadocian economies, Strabo emphasizes the presence of large religious institutions, centered on city-sanctuaries and controlling extensive agricultural land and manpower. The author, in particular, describes the large sanctuaries of Ma at *Comana* (in *Cataonia*) and of Zeus at *Venasa*, (in the district of *Morimenê*):

> "In this Antitaurus are deep and narrow valleys, in which are situated Comana and the temple of Enyo, whom the people there call "Ma". The priest is master of the temple, and also of the temple-servants, who on my sojourn there were more than six thousand in number, men and women together. Also, considerable territory belongs to the temple, and the revenue is enjoyed by the priest. He is second in rank in Cappadocia after the king; and in general the priests belonged to the same family as the kings" (Strabo, Geography: XII.2.3).

> "In Morimenê, at Venasa, is the temple of the Venasian Zeus, which has a settlement of almost three thousand temple-servants and also a sacred territory that is very productive, affording the priest a yearly revenue of fifteen talents. He, too, is priest for life, as is the priest at Comana, and is second in rank after him" (Strabo, Geography: XII.2.6).

After a long description of the northern Anatolian regions of Paphlagonia, Pontus, and Bithynia

(XII.3-4), in chapter 5 and 6 of Book XII, Strabo describes the regions bordering Cappadocia to the north and west, respectively being Galatia (XII.5) and Lycaonia (XII.6). In the brief account of the former, Strabo is mostly concern on the ethnic and tribal organization of the Galatian celts that settled this region of Anatolia (see Section 1.2.6), without providing much information on their economic organization. Worth noting is the mention of *Pessinus* as an important trade center in this region, and the description of the Tuz Gölü (lake *Tatta*) (Section 1.1.1). More informative for the purposes of this dissertation is the description provided by Strabo of Lycaonia, which border Cappadocia to the west and extends south of the Tuz Gölü.

> "... the plateaus of the Lycaonians, are cold, bare of trees, and grazed by wild asses, though there is a great scarcity of water; and even where it is possible to find water, the wells are the deepest in the world, just as in Soatra, where the water is actually sold (this is a village-city near Garsaüra). But still, although the country is unwatered,1 it is remarkably productive of sheep; but the wool is coarse, and yet some persons have acquired very great wealth from this alone. Amyntas had over three hundred flocks in this region. There are also two lakes in this region, the larger being Lake Coralis [Beyşehir Göl] and the smaller Lake Trogitis [Suğla Göl]. In this neighbourhood is also Iconium [Konia], a town that is well settled and has a more prosperous territory than the above-mentioned ass-grazing country" (Strabo, Geography: 12.6.1).

The description of Lycaonia provided by Strabo, further reiterates the ecological and agropastoral fragmentation on the Anatolian Plateau, an aspect that will be further emphasized by the case study presented in the chapters that follow (Part II), which illuminates parts of the history of agriculture during the 1st millennium BCE in the Tyanitis – a region, in Strabo's words, having *"for the most part fertile and level"* (Strabo, Geography: XII.2.7).

2.4 Summary

Chapter 2 introduced the available sources informing on ancient Anatolian agriculture throughout the time period covered by this dissertation. The chapter is divided in three main sections, covering respectively the archaeobotanical (Section 2.1), palynological (Section 2.2), and textual (Section 2.3) records. In addition to provide a literature survey on the available datasets from the Anatolian Peninsula, a methodological introduction has been provided. I noted (Section 2.1.2) an important intensification in archaeobotanical research in the past two decades. The archaeobotanical knowledge of Anatolia has consequently significantly improved, important regional and chronological gaps are, however, still present (Section 2.1.3 and 2.4). The earlier textual sources available from central Anatolia date to the Middle Bronze Age and are associated with the Assyrian trading centers established on the plateau (Section 2.3.1). The Hittite textual records concerning agricultural production have been discussed in Section 2.3.2, emphasizing long-standing issues in the translation of crop names. I discussed the structure of the Hittite agricultural system and presented a selection of sources. Sources dating to the Iron Age were discussed in Section 2.3.3, in particular in relation to the evidence originating from the Anatolian hieroglyphic tradition. Section 2.3.4 covered the Achaemenid and Hellenistic period, with a focus given to Book XII of Strabo's *Geography*.

PART II

The agricultural landscape of the ancient Tyanitis (southern Cappadocia) in the late 2nd and 1st millennia BCE: archaeological and archaeobotanical evidence

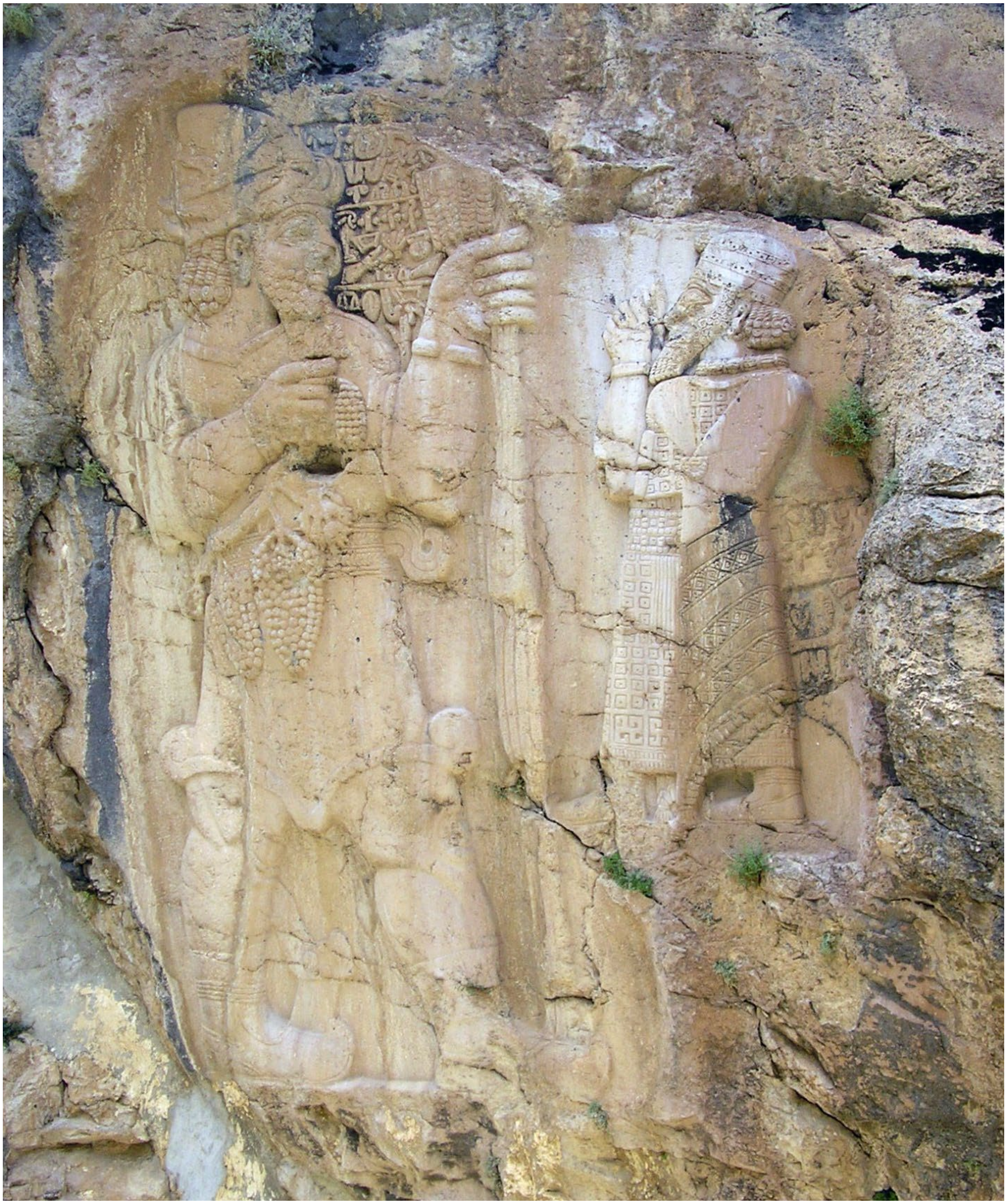


Figure II.1 – *rock relief from Ivriz.*

CHAPTER 3

Southern Cappadocia:

A geographic, historical, and archaeological introduction to the ancient Tyanitis

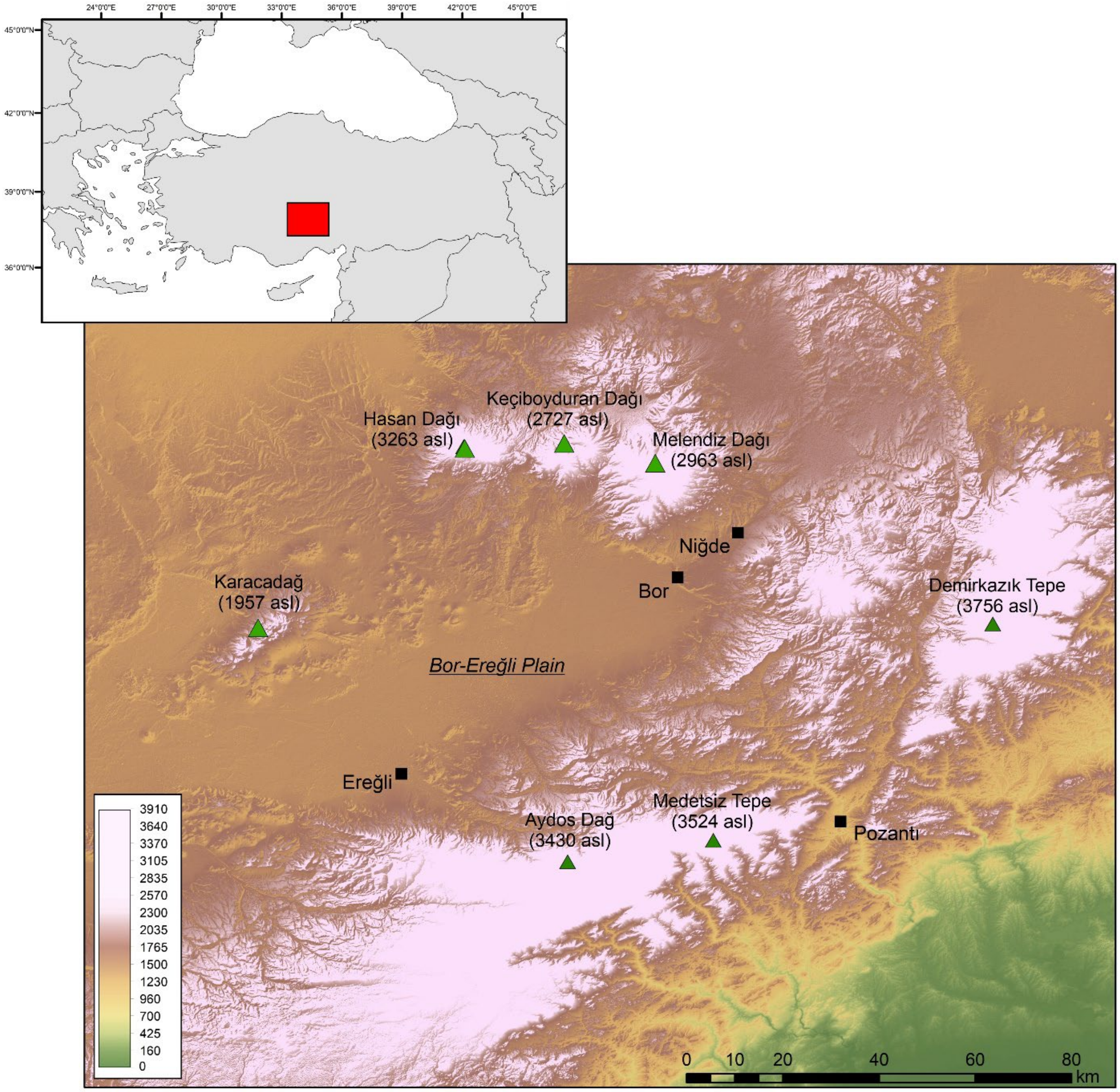
As outlined in the introductory paragraph, Part II of the dissertation concentrates on archaeological (Chapter 4) and archaeobotanical (Chapter 5 and Chapter 6) data originating from the site of Niğde-Kınık Höyük. This evidence represents the original dataset produced in the framework of the dissertation, which within the broader Anatolian context (Chapter 7), aims to illuminate the development of the local and regional agricultural system in the time period considered in this project. Before moving to the archaeological and archaeobotanical study, I shall thus introduce the study region where the site of Kınık Höyük is located: southern Cappadocia, the ancient *Tyanitis*. This chapter is organized into three main sections: (*i*) I will provide an outline of the physical geography of southern Cappadocia (section 3.1); (*ii*) I follow up with a discussion of the local pre-mechanized agricultural economy (section 3.2); (*iii*) I will, finally, summarize the history (section 3.3) and archaeology (section 3.4) of the region, focusing on the periods covered by the case studies presented in the following chapters – i.e., from the Late Bronze Age (1600-1200 BCE) until the beginning of Roman rule (1st century CE). In discussing the regional archaeology, particular relevance will be given to the site of Kınık Höyük.

3.1 The physical geography of southern Cappadocia

3.1.1 *Location and topography: the Bor-Ereğli Plain and the surrounding mountain ranges*

Central Anatolia is defined by a complex, in many respects unique, physical geography: a high plateau (~1100-1200 m asl) located at the center of a peninsula protruding into the Mediterranean Sea and crowned by high mountain chains (Chapter 1).

Southern Cappadocia is situated on the southernmost portion of the Anatolian Plateau (Figure 3.1). This region roughly corresponds to the Bor-Ereğli Plain and the foothills of the surrounding mountains. The Graeco-Roman regional toponym, *Tyanitis* (e.g., Strabo, Geography: 12.2-7), originates from the most important urban center therein present: the classical city of *Tyana,* identified as Iron Age *Tuwana*, Bronze Age *Tuwanuwa*, modern Kemerhisar (Section 3.3).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27°0'0"E
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39°0'0"E
42°0'0"E
45°0'0"E
45°0'0"N
42°0'0"N
39°0'0"N
36°0'0"N
Keçiboyduran Dağı
(2727 asl)
Hasan Dağı
(3263 asl)
Melendiz Dağı
(2963 asl)
Niğde
Bor
Karacadağ
(1957 asl)
Demirkazık Tepe
(3756 asl)
Bor-Ereğli Plain
Ereğli
Medetsiz Tepe
(3524 asl)
Aydos Dağ
(3430 asl)
Pozantı
3910
3640
3370
3105
2835
2570
2300
2035
1765
1500
1230
960
700
425
160
0
0
10
20
40
60
80
km

Figure 3.1 – *Physical geography of southern Cappadocia. Digital Surface Model extracted from ALOS World 3D-30m (AW3D30) (Tadono et al. 2014). Figure realized in ArcMap 10.8.1.*

The Bor- Ereğli Plain is roughly elliptical in shape, oriented from southwest (town of Ereğli) to northeast (town of Bor). On three sides the plain is bordered by mountain ranges: the Central Taurus to the south (Bolkardağları) and southeast (Aladağlar), and the Cappadocian volcanic massif to the north (Hasandağı, Keçiboydurandağ, and Melendizdağları). To the west, Upper Pleistocene volcanic flow deposits partially divide the Bor-Ereğli from the proper Konya Plain (Figure 3.1).

Crowning the southern fringes of the Bor- Ereğli Plain, the Central Taurus chain is divided into two separate mountain ranges: the Bolkardağları and the Aladağlar.[9] The former extends from the Göksu Valley (near Silifke) to the Çakıt Çayı (near Pozantı). Yıldız Tepe (3134 m asl), Aydos Dağ (3430 m asl), and Medetsiz Tepe (3524 m asl) are the highest peaks of this mountain range (Figure 3.1). The Göksu Valley and the Çakıt Çayı, the latter commonly referred in non-Turkish scholarship as the "Cilician Gates", provide natural communication routes crossing the otherwise steep Central Taurus chain (Figure 3.2). These two valleys represented, from protohistory until present, supraregional arteries connecting the Anatolian Plateau to the Mediterranean coast (Matessi 2021).

Extending to the south and southeast of the modern city of Niğde, the Aladağlar defines the southeastern border of the Bor-Ereğli Plain (Figure 3.1). This mountain range is comparatively short (60 km-long), and it is oriented from southwest to northeast. While the northwestern sector of the Aladağlar is comparatively gentle, its southeastern portion is steep, reaching maximum elevation at Demirkazık Tepe (3756 m asl) (Figure 3.1).

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[9] The terminology used in the literature to refer to the different sectors of the Taurus chain is often inconsistent and/or ambiguous (Kürschner 1984: 12-15). For consistency, throughout the dissertation I will follow the terminology provided by Kürschner (1984).

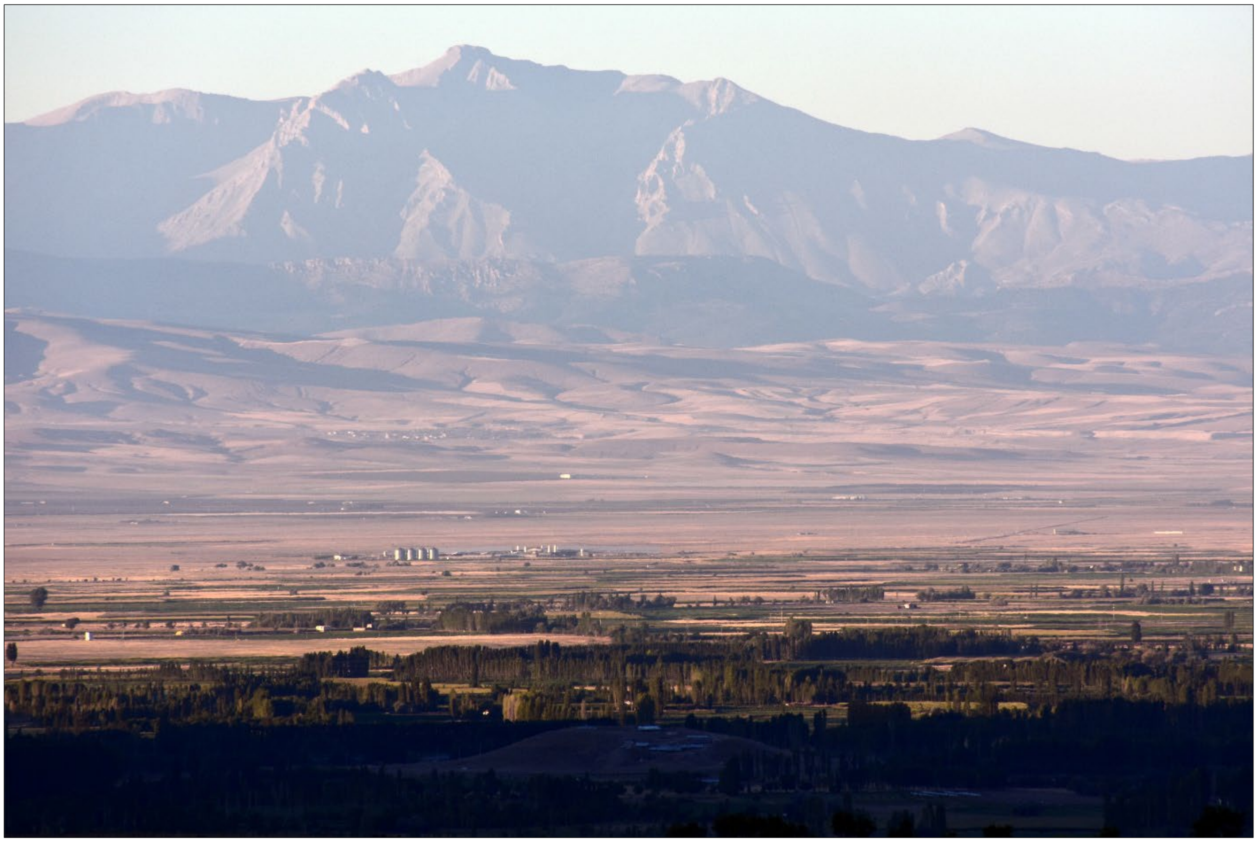

Figure 3.2 – *View of the northern piedmont of the Central Taurus chain (Bolkar Dağları), in foreground the northern portion of the Bor Plain and the archaeological site of Niğde-Kınık Höyük.*

To the west, southern Cappadocia is bordered by volcanic flow deposits, which partially divides the Bor-Ereğli from the nearby Konya Plain. The northern limit of our study region is defined by three volcanoes, which are part of the Cappadocian Volcanic Complex – from west to east: the Hasandağı (3263 m asl), Keçiboydurandağ (2727 m asl), and Melendizdağları (2963 m asl) (Figure 3.1). Volcanic activities in this district of central Anatolia are to a large extent pre-Holocene in date (e.g., Kuzucuoğlu 2019), with only single eruptions attributed to the Late Pleistocene and the Early Holocene (Kuzucuoğlu 2019, Schmitt et al. 2014).

The Altunhisar Valley separates the Keçiboydurandağ and the Melendizdağları (Figure 3.3). This latter valley, wide and with gentle slopes, hosts summer pastures (*Yaila*) and provides a natural communication route connecting the Bor Plain to the Çiftlik Plateau (Matessi et al. 2016). A ca. 20 km wide corridor divides the Melendizdağları from the Aladağlar massif (Figure 3.1). At the center of this corridor, it is located the town of Niğde, capital of the homonym Turkish province. The Niğde corridor represents a further important communication route, connecting southern Cappadocia to northern and eastern districts of the central Anatolia Plateau (Matessi et al. 2016).

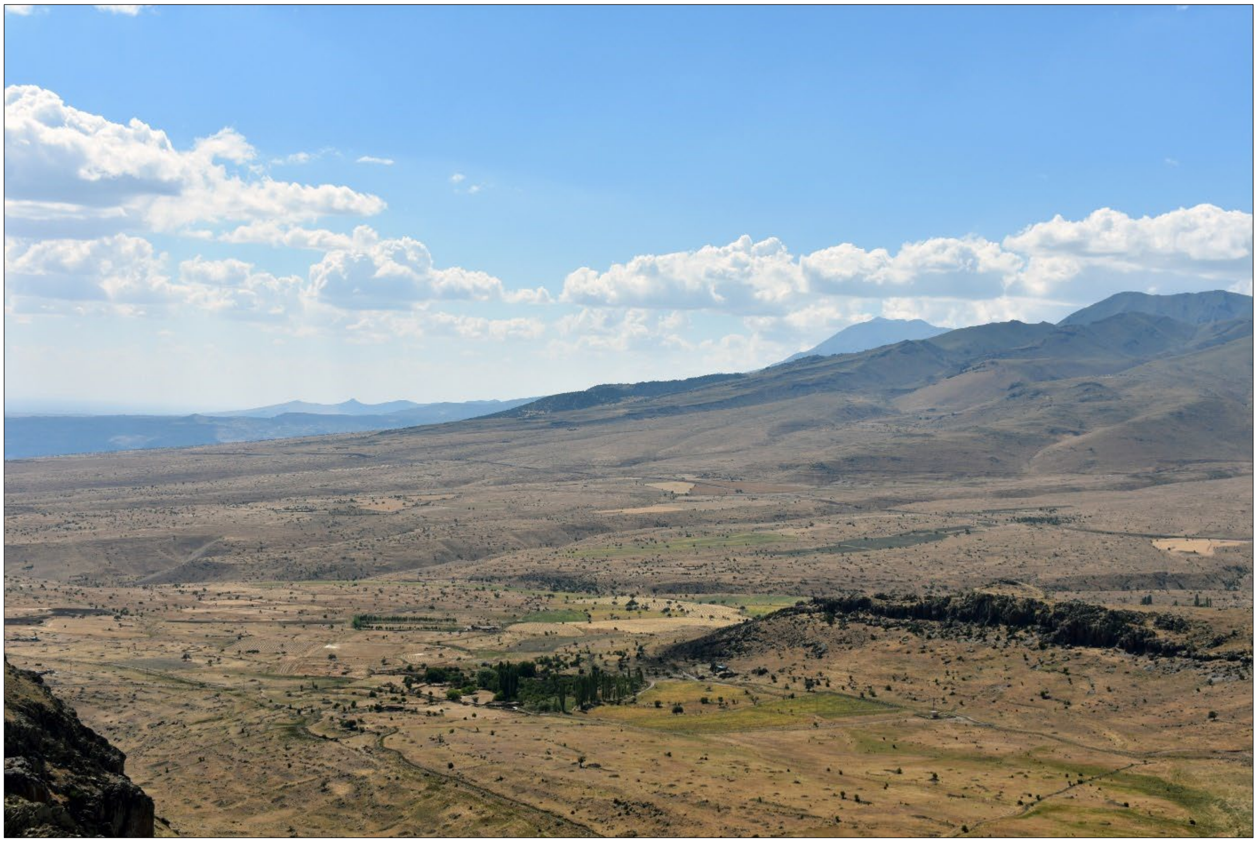

Figure 3.3 – *View from north to south of the Althunisar Valley, extending between the Keçiboyduran Dağı and the Melendiz Dağı.*

3.1.2 *The modern climate in southern Cappadocia*

At a regional and local scale, the complex physical geography of the Anatolian peninsula directly impacts its climatic zonation: temperatures and precipitations are in large part correlated to proximity to the seacoast and elevation (Türkeş 2003) (Section 1.1). In these regards, the climate of southern Cappadocia falls in the expected central Anatolian regime (e.g., Türkeş 2003), both in terms of seasonality and average annual values.

The climate of our study region is classified as cold semi-arid, with average total annual precipitation varying from 280 to 370 mm, mean January temperature of 0 °C, and mean July temperature of 22 °C (Figure 3.4). Precipitation mainly occurs in spring and winter, with summer as the driest season. The concomitance of low precipitation, often almost absent for the months of July and August, and high temperatures cause recurrent meteorological droughts during the hot season.

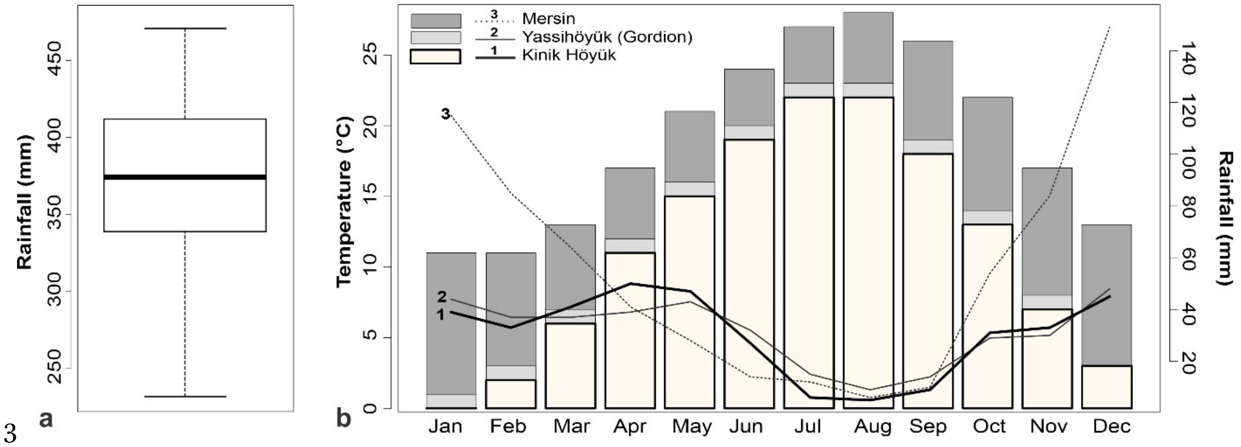

Figure 3.4 – (a) *boxplot of average annual precipitation recorded at the meteorological station of Niğde* (*1935-1946*) – *data from Meteorological Central Office* (*Ankara*); (b) *ombrothermic diagram for Kınık Höyük, Gordion* (*north-western central Anatolia*), *and Mersin* (*Cilicia*) - *data extracted from WorldClim2 30 seconds dataset 1970-2000* (*Fick and Hijmans 2017*).

In the region, there is a marked altitudinal precipitation gradient, with significantly wetter conditions occurring at higher elevations on the mountains crowning the Bor-Ereğli Plain – i.e., the southern Cappadocian volcanoes and the northern slopes of the Central Taurus (Figure 3.5). These differences in precipitation directly impact the local flora, determining an altitudinal zonation in vegetation communities (Section 3.1.4).

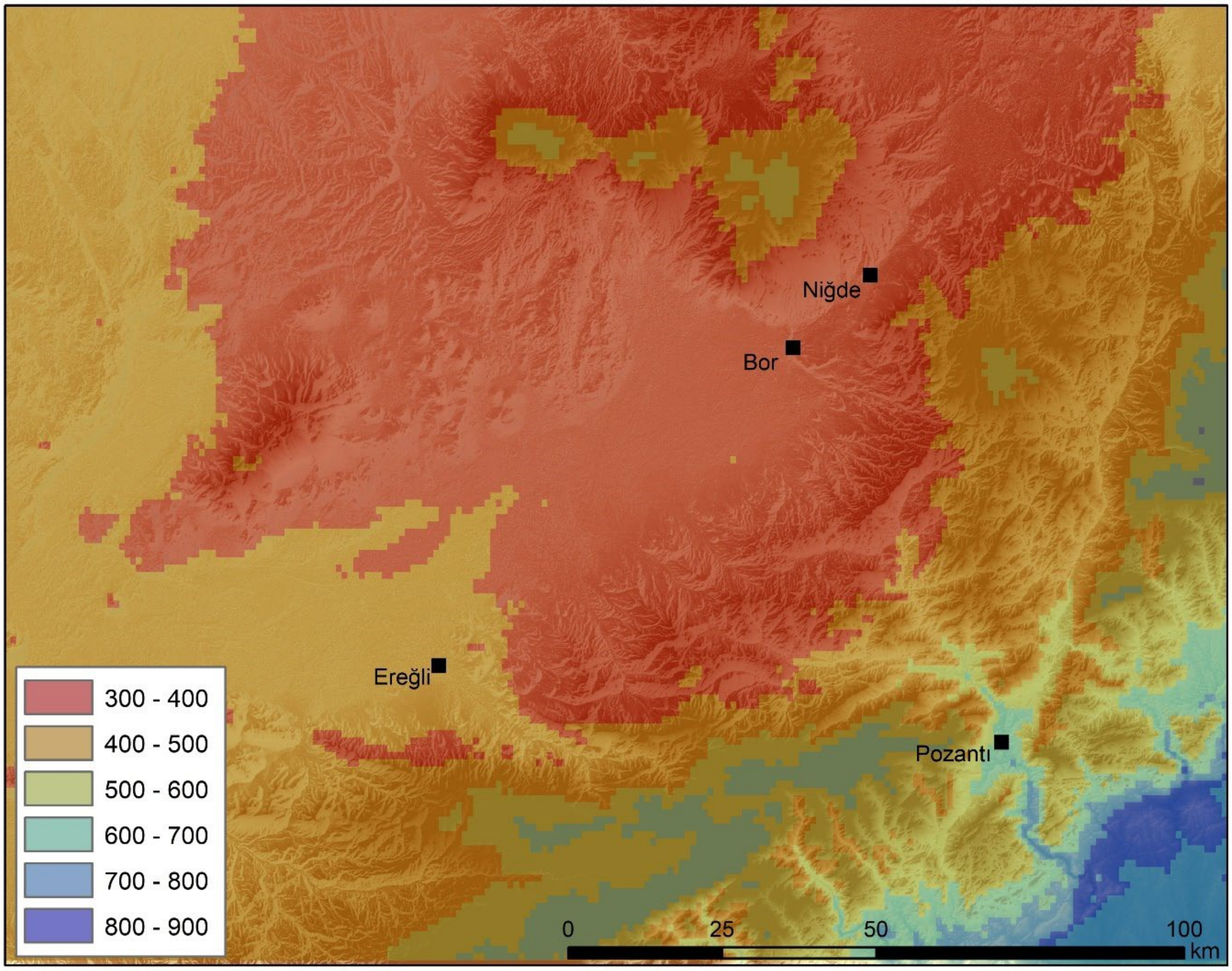

Figure 3.5 – *Average annual precipitation for southern Cappadocia. Data extracted from WorldClim2 30 seconds dataset 1970-2000 (Fick and Hijmans 2017). Figure realized in ArcMap 10.8.1.*

The comparatively abundant precipitation occurring at higher elevations are, furthermore, of key importance in determining the underlying hydrography. Southern Cappadocia is an endorheic basin – i.e., with no outflow to any sea. The precipitation occurring in the nearby mountains during the cold season feeds a number of streams and springs, which results in the formation of highly dynamic humid ecosystems in the floodplain and surrounding piedmont areas (Section 3.1.3).

3.1.3 *Hydrography: lakes, marshes, and springs in southern Cappadocia*

Southern Cappadocia is part of a broader endorheic district of central Anatolia, which also includes the Konya Plain, the Tuz Gölü, and the Lake District (Kuzucuoğlu 2019) (Section 1.1). This hydrographic setting underlies the formation of inland water bodies, which develop during phases of positive water balance, the latter in a natural setting chiefly defined by the budget between precipitation and evapotranspiration (Berger et al. 2016). During the Late Pleistocene, this broader hydrographic region of central Anatolia was occupied by large terminal lakes, which reached maximum extension during the Last Glacial Maximum (~23000-16000 BP). These paleolakes are documented in sedimentological sequences from the Konya (Kuzucuoğlu et al. 1997, 1998, 1999; Fontugne et al. 1999; Roberts et al. 1999), Tuz Gölü (Naruse et al. 1997; Kashima 2002), and Bor-Ereğli (Gürel and Lermi 2010, Bayer Altin et al. 2015) basins.

During the Late Pleistocene, the Bor-Ereğli Plain was, thus, occupied by a large terminal lake (Gürel and Lermi 2010, Bayer Altin et al. 2015). The subsequent Holocene history of these humid ecosystems is characterized by several phases of expansion, retreat, and drying, in response to climate change and, in later periods, water management (Matessi et al 2016). Following modern reclamations and hydraulic works, including dam construction, to date humid environments are mostly restricted to relict marshes in the southeastern sector of the plain, near Ereğli. The former presence, prior to modern water management works, of widespread wetlands is documented in the mid-twentieth century cartography (d'Alfonso and Mora 2008) and in the survey map of Kürschner (1984, *karte* 11) (Figure 3.6). In response to negative water balance during arid climatic phases, and to some extent each year during the summer dry season, these humid landscapes are prone to salinization – the nearby Tuz Gölü, the "Salt Lake", is a well-known large-scale example of these dynamics. Until recently, as documented by Kürschner (1984, *karte* 11), salt marshes were extending also into the northern sector of the Bor Plain, in proximity of Kınık Höyük.

The humid ecosystems present on the Bor-Ereğli Plain are watered by surface run-off, streams, and springs. Seasonal streams and rivers originate from precipitation and snow-melting occurring on the mountains bordering the plain. A further important source of water are the numerous karstic springs present along fault lines on the mountain piedmont (Matessi et al 2016). Precipitation occurring on the mountain slopes is absorbed by the porous volcanic deposits, water is retained by the underlying limestone formations, for then emerging at the foothills of the mountains. Some of these springs are active throughout the entire year, forming small ponds along their proximity (Pfeifer 1957). This hydrographic setting is further connected to the presence of a comparatively high-water table (Pfeifer 1957). The latter, however, is expected to have been recently significantly lowered by an exponential intensification in water extraction, due to widespread and unregulated irrigation of water-demanding crops.[10]

- *Holocene hydrography and climate*

The central area of the Bor-Ereğli Plain corresponds to the floor of a Late Pleistocene terminal lake, which according to Gürel and Lermi (2010) reached maximum extension between ca. 22000 – 17000 BP. After the Last Glacial Maximum, the lake underwent a dry phase, which is in turn followed by the formation of a shallow freshwater lake dated between 12500 – 11000 BP (Gürel and Lermi 2010). Similar episodes of formation of shallow lakes are documented also throughout the Holocene, interspersed by dry episodes and phases of marshes development (Matessi et al 2016). The high dynamicity of these environments is connected to their sensitivity through changes in the hydrographic balance, an aspect that makes these ecosystems a favorable proxy for the study of climatic change (Kuzucuoğlu 2012). Research on the Holocene climatic and geomorphological history of these environments has been conducted by Catherine Kuzucuoğlu (Laboratory of Physical Geography, CNRS-INEE/Paris-1 University), in collaboration with Ali Gürel (Ömer Halisdemir University, Niğde) and members of the Niğde-Kınık Höyük project (e.g., Castellano et al., forthcoming). Pending final publication of the palaeoecological study, the considerations that follows are provisional.

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[10] Summer irrigated crops, mostly forage (e.g., *Medicago sativa*) are currently intensively cultivated in the region. Data on the impact of modern agriculture on the water table are available for the nearby, and in many respects similar, Konya basin (e.g., Topak and Acar 2010).

In the published literature, the Early Holocene local paleoenvironmental evidence has been summarized by Bergeret et al. (2016), which followed a preliminary discussion provided by Gürel and Lermi (2010). At the onset of the Holocene (~11700 BP), the shallow depressions present in the plain were occupied by wet environments (Bottema and Woldring 1984, Bergeret et al. 2016). The 7th millennium BCE is characterized by a generalized drying trend, with, however, some discrepancies between the northern and southern sectors of the plain (Bergeret et al. 2016). This millennium ended with a short-lived yet pronounced dry phase (Bergeret et al. 2016), which could be associated to the so-called 8.2k BP climatic event (Mayewski et al. 2004). The Middle Holocene began with a humid period, documented by an expansion of humid environments in the plain, dated from ca. 5950 to 4550 BCE (Bergeret et al. 2016). The end of this humid period marks the beginning of a mid-Holocene dry phase (Bergeret et al. 2016).

Preliminary data on the Late Holocene climate history of the region are available in Matessi et al 2016, and Kuzucuoğlu et al. *forthcoming*. The available sedimentary records suggest the presence of a humid phase from ca. 2850 to 2550 BCE, which is followed by a dry period (Matessi et al 2016). Wetter conditions resumed again at about 1900 BCE, as recorded by the development of marshes and shallow lakes in different sectors of the plain. This comparatively humid phase extends until a shift towards a semi-arid trend starting at ca. 1350 BCE (Matessi et al. 2016). All the sampled sequences indicate a sedimentary hiatus in the 12th century BCE, pointing to an important dry event. An arid phase at the transition from the Late Bronze and Early Iron Age has been identified in several other eastern Mediterranean records (e.g., Weiberg and Finne 2018), indicating a major disruption in the supraregional climate, referred in the literature as the 3.2-3.0k BP event (Knapp and Manning 2016). After this dry phase, humid conditions partially resumed at about 1050–900 BCE (Matessi et al. 2016). A subsequent return to a dry phase is suggested by an erosive crisis dated from 900 to 850/800 BCE, which is followed by an increase in humid at 850–500/450 BCE (Kuzucuoğlu, *forthcoming*). The hydrographic and climatic dynamics characterizing the second half of the 1st millennium BCE, and potentially also earlier periods, are of difficult interpretation. It is in fact possible, if not likely, that the dry signals recorded in several sequences (Kuzucuoğlu, *forthcoming*) could be in part connected to an increase in water management rather than to climatic factors. This hypothesis is supported by the archaeobotanical evidence I will present in Chapters 5 and 6, which points to a concomitant intensification in the cultivation of water-demanding crops.

In addition to sedimentological evidence, the former presence in the Bor-Ereğli Plain of extended humid environments is supported by Late Bronze Age (Hittite) cuneiform sources (Matessi et al. 2016). CTH 719.1 (KUB 20.1) refers to a festival occurring in Cappadocia (Börker-Klähn 2007: 99;

Beckman 2015). According to the surviving portion of the text, at least one part of the festival took place in the city of *Tuwanuwa* – a toponym identified with the modern town of Kemerhisar, classical *Tyana*, in the eastern sector of the Bor Plain (Section 3.3). As part of the festival, a procession visited the cultic statue to the divinized ^{d}*Aruna* – the latter term in Hittite referring to a large water body (sea or lake) (Matessi et al. 2016).

A second textual passage to be mentioned is found in the Deeds of Suppiluliuma, the *res gestae* of Hittite great king written by his son and successor Mursili (CTH 40; del Monte 2008: 32-35). More specifically, of relevance in our discussion is the passage informing on the so-called "Battle of *Tuwanuwa*", opposing the Hittite army and the *Arzawa* enemy. After a first clash at *Anisa*, the defeated *Arzawan* army split into three groups. One of these units, led by a commander named *Anna*, reached Mt. *Amuna*, for then crossing the land of *Tupiziya*, another place not preserved in the text, a pond/spring (Hittite *luli*), for finally reaching and putting under siege the town of *Tuwanuwa* (modern Kemerhisar; Section 3.3). In describing the route to *Tuwanuwa*, likely coming from northwest, either a pond or a spring is mentioned, which would thus further support the presence of humid environments in the Bor Plain during the Late Bronze Age. Matessi et al. (2016) provide a detailed discussion of the available textual sources, with further bibliographic references.

Leaving to forthcoming research a discussion at a finer scale of the Late Holocene geomorphological and hydrographic history of southern Cappadocia, there are three main general points that need to be emphasized: (*i*) the endorheism of southern Cappadocia underlies the development of highly dynamic humid environments; (*ii*) during the Late Pleistocene, the Bor-Ereğli

Plain was occupied by a large terminal lake. Throughout the Holocene, changes in the local climate correspond to phases of expansion and retreat of these ecosystems; and (*iii*) that despite the semi-arid conditions, southern Cappadocia is a region comparatively rich in water, a fact that holds direct and important implications on the local vegetation (Section 3.1.4), agricultural potential (Section 3.2), and economic history (Section 3.3).

3.1.4 *An introduction to the vegetation of southern Cappadocia*

The physical geography of southern Cappadocia, outlined in the previous sections, underlies the complex phytogeography of the region. In approaching the vegetation of our study region, and in general of the Anatolian peninsula, the monumental work of P.H. Davis (Flora of Turkey, 1965-1985) represents an essential bibliographic starting point. The Cappadocian vegetation is, furthermore, described in the Taurus-Pontus transect of Zohary (1973). An important source of information on the regional vegetation is also the survey of the Central Taurus vegetation provided by Kürschner (1984), which includes in its work also the southern Cappadocian volcanic district. At a finer scale, the flora of the Cappadocian volcanoes has been subjected to a number of studies, with particular emphasis on the Melendiz (Kenar 2014; Kenar and Katenoğlu 2016) and Hasan (Başköse and Dural 2011) mountains.

As most of Anatolia, long-term anthropogenic pressure – e.g., clearances, firewood exploitation, and overgrazing – have significantly impacted the local flora. The vegetation of the Cappadocian volcanoes (Figure 3.1) is emblematic in these regards: the slopes of the Hasandağı, Keçiboydurandağ, and Melendizdağları were very likely formerly covered by a belt of cold deciduous forest, which is currently almost entirely degraded into scrubs or overgrazed thorn-cushions vegetation (Kürschner

1984) (Figure 3.6).

The current patchy remnants of this forest belt extend on deep soils at an elevation comprised between ca. 1250/1300 and 1600 m asl. This altitudinal zonation is determined by annual precipitation (lower treeline) and winter temperatures (upper treeline). Deciduous oaks – mainly *Quercus cerris*, but also *Q. libani*, *Q. pubescens* ssp. *anatolica*, *Q. vulcanica* – are the dominant taxon of these woodlands, associated to a number of Rosaceae trees and shrubs – e.g., *Crataegus monogyna*, *C. orientalis*, *Pyrus eleagnifolia*, and *Sorbus torminalis* (Kürschner 1984). Forests with comparatively old stands are currently present only in limited areas on the northwestern and western slopes of the Hasan Dağ. In other sectors of the Hasandağı and Melendizdağları, the former forest is otherwise degraded into a patchy scrub (Figure 3.7b). These forests/scrubs are interspersed by large areas occupied by a xeromorphic dwarf-shrublands with thorn-cushions vegetation, most likely resulting from overgrazing.

Isolated rosaceous trees/shrubs are widespread on the deforested mountain slopes, especially in and around arable fields and grazed areas. The presence of isolated trees of economic importance, either for the fruits they produce (e.g., *Prunus cerasifera*) or as rootstock for cultivated varieties (e.g., *Pyrus eleagnifolia*), is relatively common throughout central Anatolia. Zohary (1973: 363) has named these associations as 'wild orchards', interpreting them as resulting from selective deforestation of the original deciduous oak forest. These trees, according to Zohary, represent the remains of the "*... former dry oak forest from which the oaks and the other 'useless trees' have been removed, in favor of those which bears edible fruits or on which fruit trees can be grafter*" (Zohary 1973: 363). This hypothesis, however, remains debated in the literature (e.g., Woldring and Cappers 2001).

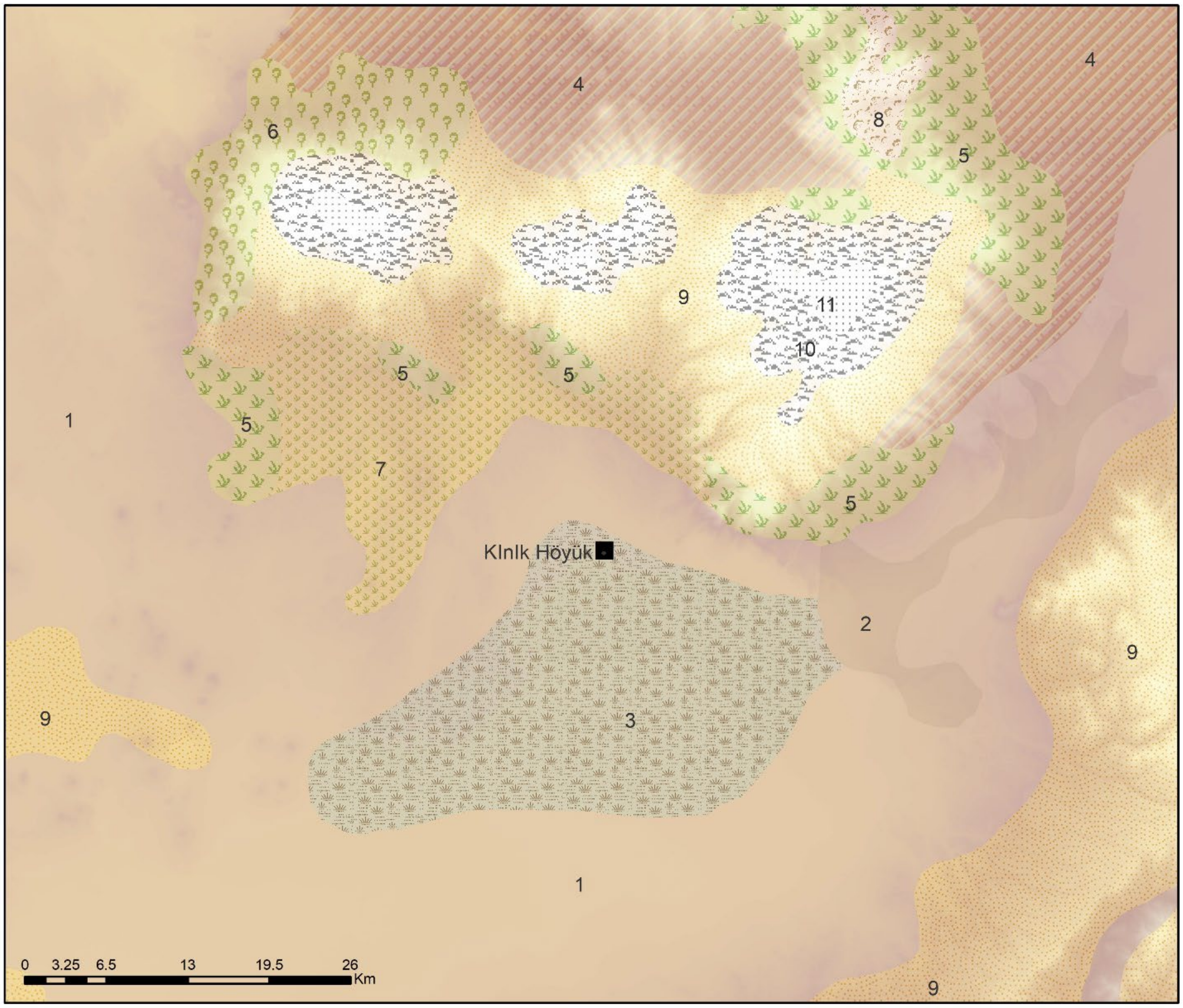

Figure 3.6 – *Simplified vegetation map (redrawn after* Kürschner 1984*). Symbology: not-irrigated arable land (1), irrigated arable land (2), mixed rush and salt swamp, currently reclaimed (3), not irrigated arable land potentially open forest (4), cold-deciduous scrub (5), cold-deciduous woodland (6), xeromorphic dwarf-shrublands with thorn-cushions mixed with not irrigated arable land potentially open forest (7), Juniperus woodland (8), xeromorphic dwarf-shrublands with thorn-cushions (9), sub-alpine vegetation (10), alpine vegetation (11). Figure realized in ArcMap 10.8.1.*

(Next page) Figure 3.7 – *Examples of southern Cappadocian vegetation associations: (a), view from the mound of Niğde-Kınık Höyük looking northward, in the background the Melendiz Mountain; (b), deciduous open oak (*Quercus *spp. deciduous) forest on the southern slope of the Hasan Dağı; (c), lower limit of the oak open forest near Altunhisar, scattered trees and stone clearances; (d), heavily managed riparian vegetation in the Yeşilyurt Valley; e, gardens surrounding the village of Yeşilyurt.*

a
b
c
d

A distinctive aspect of the vegetation in the Cappadocia volcanic district is the complete absence of natural (i.e., not planted) pine (*Pinus* spp.) stands (e.g., Woldring and Bottema 2003). On the contrary, in several other central Anatolian regions, pines represent an important landscape component (e.g., Davis 1965: 72-75). Junipers (*Junipers* spp.) is the only conifer currently naturally occurring in the southern Cappadocian volcanic district (Kürschner 1984, Kenar and Katenoğlu 2016). Junipers form almost pure forests in some localities on the northern slope of the Melendiz Mountain, at elevations comprised between 1600 and 1800 m asl (Kürschner 1984) (Figure 3.6).

The Central Taurus chain, on the southern and southeastern border of the Bor-Ereğli Plain, is characterized by a far richer arboreal flora. The vegetation of the central Taurus was the subject of Kürschner's (1984) monograph, which still represents the main available reference on the topic. In addition to elevation and slope, exposure plays a crucial role in defining the vegetation zonation in the Taurus: the southern slopes, facing the Mediterranean Sea, are wetter and exposed to higher insolation; while the northern slopes have a more continental climate, colder due to lower sun exposure and drier because of orographic rain shadow (Kürschner 1984). The complex inner orography of the Central Taurus underlies the presence of a more fragmented phytogeographic layout. In this introduction, I will summarize, at a coarse scale, the main vegetation associations present on the northern and southern slopes of the Central Taurus, referring to Kürschner (1984) for a more detailed discussion.

In the southern slopes of the Central Taurus, the upper treeline is composed of a cold-resistant conifer forest. The higher elevations (between 1600–2100 m asl) receive abundant precipitation (>1000 mm year) and experience snowy winters and dry summers. These conditions favor the presence of *Abies* *cilicica* (Taurus fir) and *Cedrus libani* (Lebanese cedar) forests. *Cedrus* dominates on the wetter areas, while *Abies* is more extensively present under dryer conditions (Kürschner 1984). *Pinus nigra* spp. *pallasiana* (black 'Crimean' pine) woodlands are generally found at a lower elevation, between ca. 1000 and 1600 m asl. The latter altitudinal zone represents the ecological niche of *Pinus nigra*, being the droughts too long for this taxon at lower elevations and the winter too cold at higher elevations (Kürschner 1984). In some areas (e.g., near Pozantı), *Juniperus excelsa* (Greek juniper) woodlands can be found between the *Pinus nigra* and the *Abies-Cedrus* forests, at an elevation comprised between 1600 and 1800 m asl (Kürschner 1984). Below the *Pinus nigra* forest, the colline and montane altitudinal belts (between 500 and 1200 m asl) are dominated by *Pinus brutia* (Turkish pine), a taxon which is more drought resistant than *Pinus nigra*, but in turn more sensitive to winter frost. *Pinus brutia* is often found in association to broadleaved trees and shrubs, such as *Quercus cerris*, *Q. libani*, *Ostrya carpinifolia*, and *Styrax officinalis* (Kürschner 1984). At further lower elevations (<500 m asl), the Mediterranean evergreen broadleaved scrub is dominant (Kürschner 1984).

Drier and cooler climatic conditions occur on the north slopes of the Central Taurus, facing the Plateau, which determine a markedly different vegetation zonation. On the north slopes, closed canopy forests are rarely found in the montane and upper montane belt: due to lower precipitation, *Cedrus libani* does not occur, while the more xerophilic *Abies cilicica* can be found only in small populations, which form open woodlands. The less water demanding *Pinus nigra* ssp. *pallasiana* is, thus, the most common tree taxon, which is found in areas receiving more than 450 mm of annual precipitation, often in association to *Juniperus excelsa* (Kürschner 1984). The altitudinal belt comprised between 1200 and 1500 m asl is considered to have been originally occupied by a cold deciduous broadleaved woodland, dominated by deciduous oaks (*Quercus* spp. *deciduous*). Because of anthropic pressure, these forests are to date mostly degraded to scrub, interspersed with overgrazed areas with xeromorphic open dwarf shrubs and thorn cushions (Kürschner 1984). It should be noted that several, young, forests on the Taurus are recent plantations, as part of an intensive replanting policy promoted by the Turkish government under the 'Forest Act' (Law 6831, 31 August 1956).

In contrast to the mountain vegetation, the Bor-Ereğli Plain is currently treeless, with the sole exception of heavily managed gardens, orchards, vineyards, and poplar plantations (Figure 3.7c). Arboriculture is particularly widespread on the alluvial fans fringing the floodplain. In addition to long-term anthropic impact, the recent expansion of agricultural fields and an associated intensification in water management have drastically altered the local ecological layout. As discussed in a previous section, before modern hydraulic works, several humid environments extended on the floodplain. These environments were prone to salinization, in response to high summer evapotranspiration, which favors the establishment of halophytic vegetation communities. At the time of Kürschner (1984) survey, the northern sector of the plain was occupied by salt marshes, while in proximity of Ereğli are reported by the author swamps dominated by hydrophytic vegetation. It is highly unlikely that the oak forest present on the slopes of the nearby mountains formerly extended on the floodplain, considering both rainfall requirements and the preference of this taxon for well-drained soils (Asouti and Kabukcu 2014). The wetter soils present in the plain were, on the other hand, more suitable for the establishment of riparian woodlands. It should be noted that natural riparian forests are to date almost completely extinct in central Anatolia (Asouti and Kabukcu 2014), due to a strong and enduring anthropic pressure targeting riverine and floodplains environments.

3.2 *The traditional agropastoral economy of southern Cappadocia*

3.2.1 *Sources and research limits*

Having introduced the physical geography of southern Cappadocia, the aim of this section is to discuss the regional traditional rural economy. Specific attention will be given to the ethnographic evidence of pre-mechanized agriculture, a topic that is intrinsically intertwined with the outlined local environmental layout.

The information provided in the following paragraphs are largely based on literature (Pfeifer 1957), which is complemented by direct observations I have conducted between 2015 and 2021. Because of time and resources limits, it was impossible to include in the dissertation project a structured ethnographic study. It is, nevertheless, my hope that such research will be conducted as part of my forthcoming research. Starting in the mid-20th century, Turkish governmental programs promoted a process of agricultural modernization, which relied on the introduction of newly selected crop varieties, chemical fertilizers, and mechanized equipment (Pfeifer 1957: 84-85). Considering the profound changes associated with this 'revolution' in local agricultural practice, it is crucial to systematically record the available direct accounts informing on the local traditional farming system, before it is completely lost from the memory of local communities.

The ethnographic work conducted by Gordon Hillman (e.g., 1984a, 1985b, 1985) represents the main point of reference on traditional, pre-mechanized, cereal cultivation and processing, in Turkey and more in general western Asia. The ethnography of rural villages on the Anatolian plateau has been discussed by Stirling (1965). In more recent years, central Anatolian ethnographic studies have been published by Yakar (2000) and in a collaborative volume edited by Takaoğlu (2004). Ethnographic field work focusing on traditional farming has been carried out in specific Anatolian regions – e.g., in northern Anatolia (Filipovic 2012, Ulaş 2019c), in the Elazığ district (Hillman 1973), and in southeastern Anatolia (Ulaş 2021). A particular mention should be made to the ethnobotanical study of wild plant resources, a topic which has received significant attention in the scholarship, especially among Turkish scholars (Ertuğ 2000, with further references).

In addition to proper ethnographic field work, a further important source of information originates from research conducted by geographers working in Anatolia in the periods preceding (or shortly after) the aforementioned major changes in local agriculture. Southern Cappadocia was investigated by the German geographer Werner Pfeifer (1957). Although the observations of Pfeifer (1947) covers a limited portion of the region – i.e., the city of Niğde and nearby villages – the general trends described by the author can be very reasonably considered representative of the entire northern sector of the Bor-Ereğli Plain and the nearby foothills – encompassing, thus, also the landscape surrounding the archaeological site of Niğde-Kınık Höyük.

3.2.2 *The rural economy of the Niğde district in the mid-20th century*

Despite the semi-arid climate, southern Cappadocia is characterized by a comparative abundance of water, due to the number of mountain streams and springs present on the fringes of the Bor-Ereğli Plain (Section 3.1.3). This hydrographic layout is central to the local agricultural landscape. To a significant extent, the distribution of these water sources underlies the modern settlement pattern: villages are generally located in proximity to streams or springs, usually on the colluvial deposits at the piedmont of the mountains fringing the plain. In these villages, the traditional domestic architecture is rather simple: houses have a square plan, one (or rarely two) floor, a flat roof, and walls made in tuff (less commonly also andesite and marble). According to Pfeifer (1957: 77), at the time of his survey, an architectural use of mudbrick was limited to the few villages located in the plain – e.g., Kemerhisar, a town where mud-brick architecture can still be observed today. Domestic pyrotechnological activities involved the widespread use of pressed and dried dung cakes (Pfeifer 1957: 78), a common practice throughout central Anatolia (Anderson and Ertug-Yaras 1998). Dung cakes were generally stored on the flat rooftops or outside the buildings. During the cold season, for the purpose of domestic heating, people used the "*mangal*": a flat iron brazier, which is filled by glowing charcoal.

In the local economy, agriculture represented the main source of incomes: at the time of the Pfeifer survey the 87.6% of the workforce in the province of Niğde was employed in agricultural production, including in this statistic also are the urban populations (Pfeifer 1957: 81–82). Villages are the focal points of the agricultural landscape. The latter could be accordingly divided into three main concentric zones: gardens are present within and in proximity to the villages, in the surroundings of the settlements is located the arable land, and at a further distance the steppic landscape is exploited as grazing land. Gardens are, as a rule, irrigated; their locations and extension is consequently determined by water availability. On the other hand, until a recent expansion of the irrigation network, arable fields are reported as fully rain fed.

At the time of the Pfeifer (1957) survey, wheat, rye, and barley were the main crops cultivated in arable fields (Figure 3.8).[11] Wheat represents the main staple consumed by local populations, commonly in the form of bread or groat-based products. Rye and barley, on the other hand, are mainly used as animal fodder. Wheat and rye are often cultivated mixed in the same field, a practice attested in other regions across west Asia (e.g., Behre 1992 and therein references).

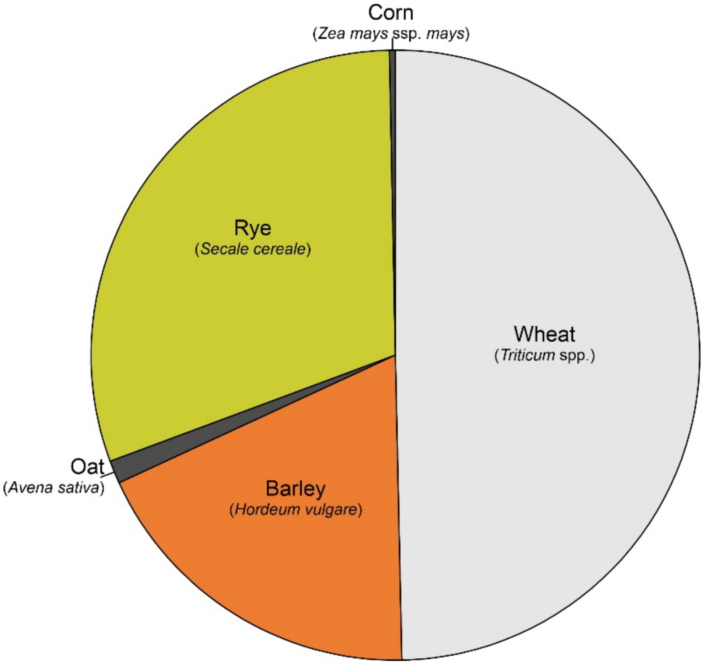

Figure 3.8 – *Cereals cultivation in the Niğde province, proportions based on hectares under cultivations. Data for the years 1941-1953 (Pfeifer 1957). Wheat and barley varieties are not specified.*

Before the introduction of western agronomic practice, annual fallowing was a common practice: every year only half of the arable land was cultivated, while the other half was kept as fallow. The latter fields were ploughed twice, first in the spring and then in the fall shortly before the sowing. Until mechanization, ploughing was conducted using a simple wooden hook-plough ("*saban*"). Little further preparations of the fields occurred, and fertilizers were basically never applied (Pfeifer 1957: 83-

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[11] In Pfeifer 1957 more precise taxonomic information are not provided. It is very likely that free-threshing wheat was cultivated. Bread wheat (*Triticum aestivum*) is to date more commonly found in the region and more in general in central Anatolia.

84). Cereal sowing takes place in concomitance to the onset of the fall precipitations, which warrant moist conditions in the soil, and consequently it results in higher germination rates. Harvest was conducted manually, using a sickle. The harvested crop was then moved to the threshing floor, generally using a two-wheeled cart driven by ox or cattle. Pfeifer (1957: 85) reports the widespread use of the threshing sledge, pulled either by cattle, ox, donkey, or horse.

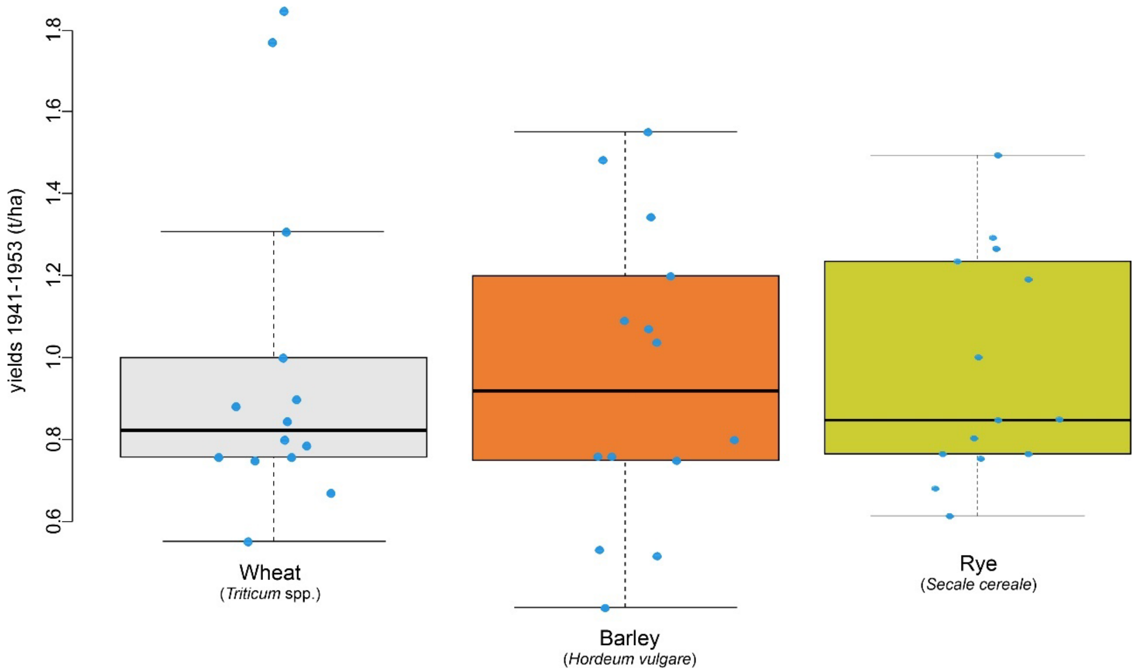


Figure 3.9 – *Yields data for the province of Niğde during the years 1941-1953* (*Pfeifer 1957*). *The wheat and barley varieties cultivated are not specified.*

Pfeifer (1957: 87–88) provides data on cumulative yields for the main arable crops, covering (with gaps) the years between 1933 and 1953 (Figure 3.9). Wheat yields range from a lowest of 550 kg/ha (1945) to a maximum of 1850 kg/ha (1948), with an average of 970 kg/ha (Figure 3.9). In order to evaluate these figures in the Anatolian context, we can compare these values to yields reported in other ethnographic surveys. Hillman (1973) provides data for fields at Aşvan (Elazığ province), which were cultivated in the mid-20th century following traditional techniques. The gross yields of wheat reported by Hillman (1973) range between 630 kg/ha (rainfed and not manured) and 1100 kg/ha (irrigated). The wheat yields from the Niğde province reported by Pfeifer (1957: 87–88) are, thus, higher than expected, especially considering the allegedly rain-fed status of these cereal fields.

Although rainfall is expected to directly affect yields, no clear correlation between the latter and annual precipitation is observed (Pfeifer 1957: 88) (Figure 3.10). This discrepancy is very well indicative of the complexity of concurrent factors determining yields. In these terms, the distribution of rainfall throughout the agricultural year would be more informative than the analysis of the cumulative annual precipitation values. Most notably, the timing of the onset of the autumnal precipitations is of key importance in determining higher germination rates. A very poor agricultural year can, in fact, be reasonably expected if the summer dry season extends into the month of November. In these latter instances farmers might opt to completely give up sowing (Pfeifer 1957: 86) or to turn to other buffering strategies.

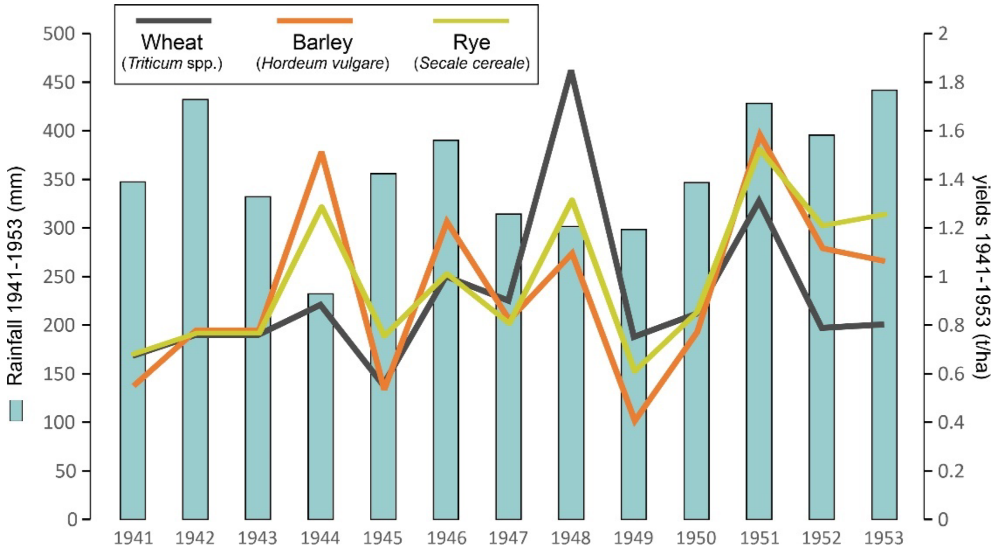
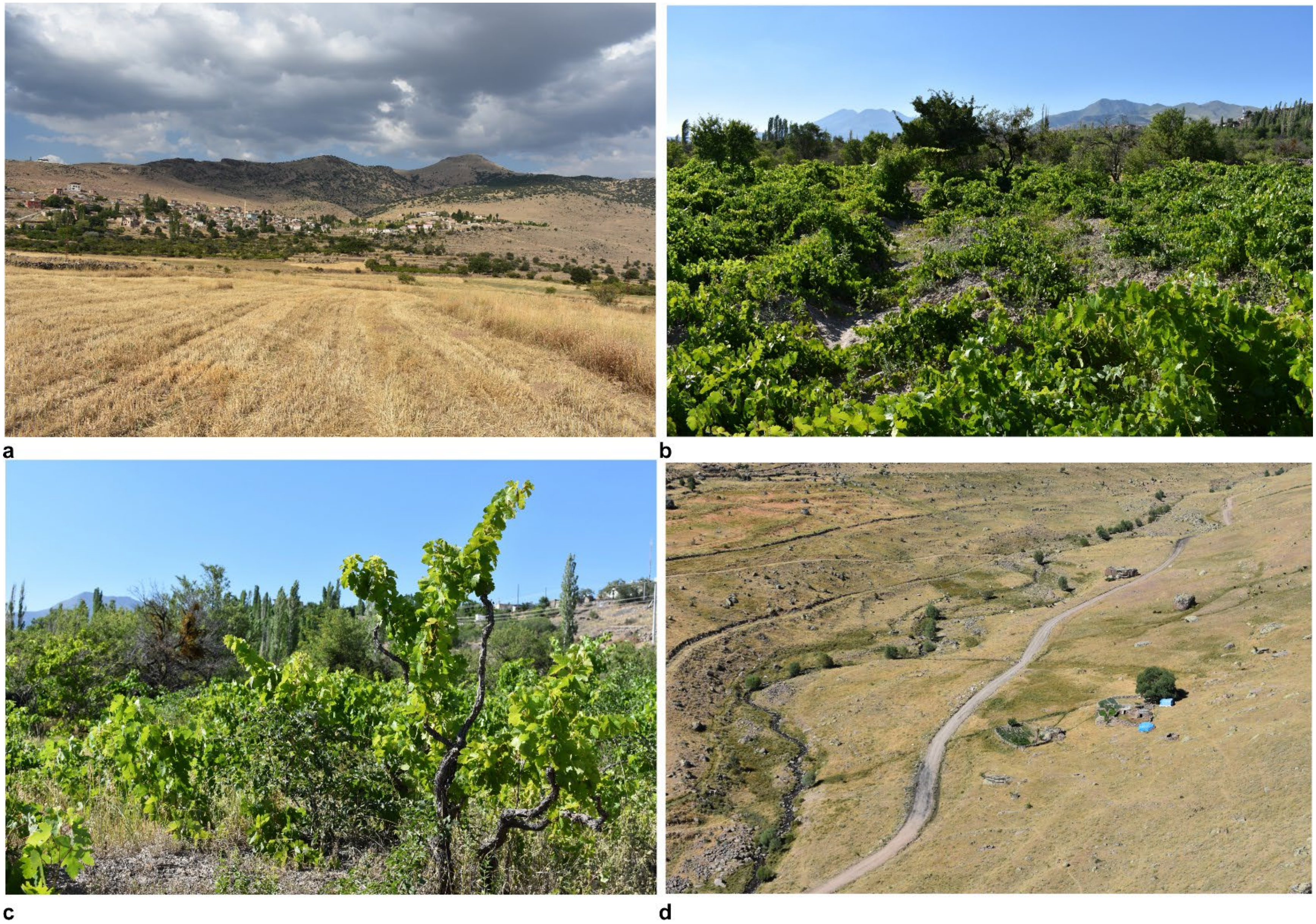


Figure 3.10 – *Comparison between annual precipitation (mm/year) and harvest in the Niğde district, data for the main cereal during the years 1941-1953 (Pfeifer 1957).*

Gardens are usually located within and in proximity to the villages (Figure 3.11), being their presence and extension chiefly determined by water availability for irrigation purposes. Water for irrigation is obtained from streams, springs, or groundwater. In the case of streams, water is diverted to gardens by means of ditches, often lined by trees in order to limit losses due to evaporation. Groundwater was traditionally extracted by means of hand-operated wells, which were technically feasible thanks to a formerly high level of the water table – at the time of Pfeifer (1957) survey, in the surrounding of Niğde present at ca. 3 to 4 meters from the surface. It is expected that groundwater has significantly lowered in more recent years, due to an exponential expansion of extraction by mean of motor pumps. The water extracted from wells was formerly used predominantly for drinking purposes, while its use for irrigation was formerly limited to water gardens during the dryer periods of the years, when the other water sources were either not available or extremely limited. The combined presence in gardens of irrigation, fertilization, and intensive tillage warrants stable and abundant yields, without the annual fluctuations and unpredictability observed in rain-fed arable fields (Figure 3.9).

In addition of being a pivotal cultural component, gardens (*bahçe*) are a remunerative aspect of the rural economy. In our study region, and more in general throughout central Anatolia, gardens can be classified into four main types: orchard, vegetable gardens, vineyards, and mixed. The latter are by far the most common in small scale tenures, with the main vegetable (e.g., tomatoes, cucumbers, eggplants, spinach, cabbage, onion, and garlic) planted under the shade of fruit trees – e.g., apples, pears, cherries, apricots, plums, peaches, mulberry, grapevines, and various nuts. Watermelon and melon are often cultivated in their own fields. Fruits are generally sold and consumed fresh, with the main exception of grapes (see below) and apricots and mulberries (sundried).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(Previous page) Figure 3.11 – (*a*)*, view of the village of Tepeköy, near Althunisar* (Niğde)*: in proximity to the village are located the gardens, which in turns are surrounded by arable fields;* (*b*)*, gardens in proximity of the village of Yeşilyurt, with extensive vineyards mixed with other fruit crops;* (*c*)*, detail of a free-standing grapevine, cultivated with the traditional local training;* (*d*)*, example of summer pastures* (Yaila) *in the Yeşilyurt valley.*

Of particular note in the Niğde region is the importance of viticulture. In addition to being present in almost all mixed gardens, grapevines are cultivated in large vineyards present throughout our study region (Figure 3.11). In vineyards, grapevines are planted on narrow ridges, in form of relatively tall free-standing vines (resembling a 'bush system' training) (Figure 3.11c). Pfeifer (1957: 98) reports that vineyards are either watered at the beginning of the growth season or not watered at all. In the first years after planting, before that the vines develop deep roots, irrigation is regarded as necessary. A large portion of the harvested grapes are sold as fresh product, while raisins are of minor economic importance. Comparatively more common is the production of the *Pekmez*, a molasses-like syrup obtained by boiled grapes. Winemaking has a central importance in 20th century southern Cappadocia, an activity rooted in a far earlier local tradition, which survived the emigration of the Greek-speaking population from Cappadocia (Pfeifer 1957: 122). The white wine produced in the region of Niğde is still appreciated throughout Anatolia (Balta 2017), although in more recent years its production has been strongly impacted by newly established government restrictions.

The aforementioned thriving agricultural landscape is not limited to the countryside, but notably it also permeates the urban spaces. The economic and cultural importance of agriculture within cities and towns is a defining hallmark of the traditional central Anatolian city, which has been accordingly defined as "*Türkischen landstadt*" (Pfeifer 1957: 102–104). Agriculture formerly represented the main economic occupation also of the urban populations. The resulting urban landscape was characterized by the presence of diffuse gardens, and to some extend even open arable fields and grazing areas. In the specific case of Niğde, the former presence of lush gardens within the city borders is noted in accounts from early modern travelers (Pfeifer 1957: 105–106, and references therein).

Animal breeding represents a second pivotal component of this agropastoral system. Grazing allows for the optimal exploitation the extensive steppe, which is widespread throughout the central Anatolian landscape, including southern Cappadocia. Pfeifer (1957: 93–97) provides data also on this sector of the local economy. At the time of the survey, the fat-tailed sheep was by far the most important livestock present in the region. Sheep were exploited for milk, meat, and wool. Angora goats also gained economic importance. Cattle were present in more limited yet increasing numbers, exploited for milk and milk derivates. Intensification of cattle breading has been noted in recent years. Oxen were the main draft animal, particularly important in pre-mechanized ploughing activities. Donkeys are by far the most common riding and pack livestock, while horses were used to a more limited extent. A final note should be made about camel, a livestock formerly used in central Anatolia for long distance transportation (e.g., Faroqhi 1982 and Inal 2021), which has almost completely disappeared after the introduction of motor trucks (Pfeifer 1957: 91).

In the local pastoral system, of particular importance is widespread practice of seasonal proximal transhumance. At the beginning of hot season, when the grazing lands in the plain are dry because of the prolonged summer droughts, the livestock – mostly sheep and goat, with fewer cattle – are herded to higher altitudes on the nearby mountains, where wetter conditions and greener summer pastures are present. Only a limited portion of the population moves to these mountain pastures (*Yayla*) (Figure 3.11). The seasonal campsites associated to these pastures are located in proximity to springs and streams, in the form of rudimentary huts and enclosures made in dry stone walls. In the region of Altunhisar, mountain pastures are on communal land, owned by the local administration and leased for use to private breeders. Livestock is kept in the mountain pastures until the fall: after the first night of frost the animals are led back to the villages. During the cold season, livestock is commonly feed with hay, a mixture of various cereals (oat, rye, and barley), and chaff (Pfeifer 1957: 94).

3.3 An Historical outline of southern Cappadocia, from the Late Bronze Age to the Hellenistic period

Southern Cappadocia has since long remained at the margins of research, despite an undoubted research potential. Archaeological investigations have traditionally focused on other regions of the Anatolian Plateau (e.g., northcentral Anatolia), leaving this study area overlocked for most of the proto-historical and early historical periods here discussed. To the limited existing archaeological understanding, it is further added a far from satisfactory and fragmented documentary record. Accordingly, one of the main aims of the Niğde-Kınık Höyük archaeological project, in which framework took place the case study included in this part of the dissertation, has been to shed new light on the cultural and historical dynamics of southern Cappadocia. Before introducing the archaeological site of Niğde-Kınık Höyük, in this section I will provide a brief historic outline of southern Cappadocia, covering the period from the Late Bronze Age to the beginning of the Common Era.

3.3.1 *Southern Cappadocia during the Hittite period* (*1600-1200 BCE*)

The core of the Hittite polity, the “Land of Ḫatti”, is located in northcentral Anatolia, within the bend of the Kızılırmak River, the Hittite *Maraššantiya* (Section 1.2.3). Southcentral Anatolia, directly adjoining to the south the “Land of Hatti”, represents an expected early direction of expansion of the Hittite polity: in addition to its proximity to the Hittite core area, the southern portion of the Plateau is located in a strategic position, granting the access to Cilicia and northern Syria. It is accordingly generally agreed that southcentral Anatolia, including southern Cappadocia, was incorporated in the Hittite polity already at an early stage of the Kingdom (Mora 2010).

Southern Cappadocia has not yet provided any Hittite written document. The available documentary evidence directly or indirectly informing on this region during the Late Bronze Age (1600-1200 BCE) is limited to cuneiform sources from the capital city of Boğazköy-*Ḫattuša* (Mora 2010). In these Hittite documents, toponyms located in southcentral Anatolia are often referred in association to the so-called ‘Lower Land’, a term indicating a possible provincial-like organization established within the Hittite polity (Forlanini 2017). The actual geographic extension of the Hittite ‘Lower Land’ remains unclear, although it is likely that it encompassed a large portion of southcentral Anatolia, including the Konya Plain and the foothills of the Central Taurus (Matessi 2016, Forlanini 2017). In the Late Empire period, during the 13th century BCE, the Lower Land is associated to the appendage kingdom of Tarhuntassa, which would further support its location in the southernmost portion of the Anatolian Plateau (Forlanini 2017). [12]

It remains a matter of debate whether the ‘Lower Land’ was established at the beginning of the

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[12] In the passage of Hattusili III's apology (CTH 81, I 75-II 2, II 52-53; Otten 1981: 10-11, 14-15), it is mentioned the Lower Land in connection to Muwatalli transfer of the Hittite capital from Hattusa to Tarhuntassa (Forlanini 2017: 239, Matessi 2016: 145 and therein bibliography).

Hittite control of southcentral Anatolia, or if it represented a later process of administrative reorganization of the Hittite territorial power. As noted by Matessi (2016), the toponym ‘Lower Land’ (KUR ŠAPLITI) occurs only in texts dated to the 14th and 13th centuries BCE, thus possibly supporting the latter hypothesis. The ‘Lower Land’ is, furthermore, paralleled by the cognate ‘Upper Land’, a term first attested during the reigns of Arnuwanda I or Tudhaliya III (first half of the 14th century) and indicating a similar province-like district extending over northern Anatolia. Matessi (2016) proposed that the two ‘provinces’ were established roughly at the same time, possibly pointing to a more generalized process of reorganization of the Hittite domain, introducing a territorial-based organization in lieu of a former town-based political landscape.

Regardless of the debate on the administrative and political organization of southcentral Anatolia, there is large agreement in reconstructing an early date for the beginning of the Hittite control of southern Cappadocia, which very likely occurred already in the early stages of the kingdom (Mora 2010). An important passage in these regards comes from the so-called “Telipinu’s Proclamation” (CTH 19; Hoffmann 1984), a reformative text dated to the late 16th century BCE. In the historical preamble included in the Proclamation, several cities (*Ḫupišna*, *Tuwanuwa*, *Nenašša*, *Landa*, *Zallara*, *Puršuḫanta*, *Lušna*) are told to have been administrated by the sons of Labarna, the latter traditionally regarded as the first dynast of the Hittite Old Kingdom (Hoffmann 1984: 14-15). The Late Bronze Age city of *Tuwanuwa*, known in the Iron Age as *Tuwana* (Hawkins 2000: 432-433), is identified with the Graeco-Roman toponym of *Tyana* (Bergens and Nollé 2000), located in the northern sector of the Bor-Ereğli, in today’s town of Kemerhisar (Forlanini 2017, with bibliography). *Tuwanuwa* appears to have represented during the Hittite period the main political center of southern Cappadocia (Mora 2010), assuming a hegemonic role that will be retained by the city also in the following historical periods (Bergens and Nollé 2000).

Tuwanuwa and southern Cappadocia are often mentioned in textual sources in relation to military activities, in particular concerning the Hittite army and the enemy of Arzawa. In the historical preamble to a decree of Hattusili III (CTH 88; Goetze 1940), it is reported that during the reign of Arnuwanda I, the *Arzawan* enemy invaded the Hittite 'Lower Land', reaching as far as *Tuwanuwa* and *Uda*. The war between Hatti and *Arzawa* is covered also by a passage from the Deeds of Suppiluliuma, written by his son Mursili (CTH 40; del Monte 2008: 32-35) (Section 3.1.3). The Hittites under the lead of the Great King Suppiluliuma defeated the enemy during a first battle at *Anisa*. After the defeat, the *Arzawan* army split into three groups: two are defeated by Suppliliuma – respectively one at *Huwana*(*wa*?) and at *Nahutiya* and *Sapparanda* – while a third, led by a commander named Anna, fled southwards. After having reached Mt. *Amuna*, Anna and his army crossed the land of *Tupaziya*, reached a place lost in a gap in the text, a pond, for the putting under siege the town of *Tuwanuwa*. The siege was broken, and the enemy dispersed by a heroic intervention of the Hittite Great King (del Monte 2008: 32-35).

The complex toponymy referred in the aforementioned passage from the Deeds of Suppiliuluma has been the focus of a number of studies (e.g., Börker-Klähn 2007, Matessi et al. 2016: 127-132). I will do not go into the details of the regional Late Bronze Age historical geography, for which I refer to Forlanini (2017). For the purposes of this historical introduction, we should note that in addition to *Tuwanuwa*, to be located in southern Cappadocia are likely also the Hittite toponyms of

Suwanzana and *Uda*. The latter toponym, already mentioned in relation to CTH 88, is identified by Forlanini (2017: 240-241) as the classical city of *Hyde*, located near the village of Akçaşehir. To be located in southern Cappadocia is possibly also the toponym of *Hupisna,* a town frequently associated in textual sources to *Tuwanuwa* (Forlanini 2017: 240). The toponym of *Nahita* very likely corresponds to Iron Age *Nahitiya* (Hawkins 2000: 514-516), on an etymological basis identified with the modern city of Niğde (Forlanini 2017: 240). The Hittite town of *Tunna* might correspond to classical *Tynna*, located at Porsuk-Zeive Tepe (Forlanini 2017: 242). Finally, the toponym of *Puduwanda*, reported in cuneiform texts from *Ḫattuša*, could be tentatively equated to classical *Podandus/Padyandus*, modern Pozanti (Forlanini 2017: 242).

3.3.2 *The Iron Age and the kingdom of Tuwana*

As discussed in Section 1.2.4, around the transition from the 13th and the 12th century BCE, the Hittite Empire collapsed: the capital Boğazköy-*Ḫattuša* was abandoned by the royal court and likely destroyed by a sequence of fires (Seeher 2001). In the aftermath of the collapse of the Hittite Empire, different regions in the Anatolia Plateau appears to have followed diverging historical trajectories (e.g., Hawkins 1988 and 2000: 73-79, Mora and d'Alfonso 2012a, Frangipane and Liverani 2013, Castellano 2018, d'Alfonso 2020). In the former core of the Empire the Early iron Age appears to have been in full rupture with the previous Late Bronze Age tradition, while historical and archaeological evidence points to a partial survival of the Hittite civilization to the end of the Bronze Age in the former eastern and southern peripheries – i.e., on the Middle (Hawkins 2000: 73-79) and Upper Euphrates (Frangipane and Liverani 2013, Manuelli and Mori 2006), and in southcentral Anatolia – including in the latter also southern Cappadocia (Mora and d'Alfonso 2012a, Castellano 2018). If dynastic continuity is currently attested only in the Upper and Middle Euphrates (Hawkins 1988), a degree of socio-cultural continuity has been more generally reconstructed in the Upper Euphrates and southcentral Anatolia based on religious (e.g., Popko 1995: 164-169), epigraphic-linguistic (e.g., Payne 2012), and archaeological (e.g., Castellano 2018, Manuelli 2012: 367-369, Mora and d'Alfonso 2012a) evidence.

In introducing the topic of the transition from the Late Bronze to the Iron Ages in southcentral Anatolia, we cannot avoid mentioning the debate surrounding the Anatolian Hieroglyphic inscriptions belonging to the so-called 'Hartapus Group' (Hawkins 2000: 430-431). These inscriptions (KIZILDAĞ-KARADAĞ-BURUNKAYA), all found in the western area of southcentral Anatolia, are the work of king Hartapu and his father king Mursilis, both of which bear the title "Great King, Hero" (Hawkins 2000: 433-442).

The royal name Mursilis intriguingly recalls the well-attested Hittite Dynastic name. Singer (1996: 68-71) took this connection a step further, hypothesizing that the Mursili referred in these inscriptions was actually Mursili III-Urhi-Teshub, the great king of *Tarhuntassa* and opponent of Suppiluliuma II during the last decades of the Hittite Empire. The title "Great King, Hero" has been, furthermore, connected to the Late Bronze Age tradition. This title during the Late Bronze Age was, in fact, a prerogative of the Hittite rulers, for then being attested in the Iron Age only at Karkemish[13] – where dynastic continuity between the Late Bronze and Iron Age has since long been reconstructed (Hawkins 1988) – and in the inscriptions of TOPADA (Hawkins 2000: 451-462) and SUVASA (Hawkins 2000: 462-463). An early date of the 'Hartapus Group' inscriptions was argued by Hawkins also on a paleographic ground, quoting from the author: "*the links of the inscriptions with the Empire Period inscription of YALBURT, the work of Tudhaliyas IV, are so close that it is difficult to contemplate a date later than the 12th century for them*" (2000: 430).

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[13] KARKEMIŠ A4b (Hawkins 2000: 80-82), KARKEMIŠ A16c (Hawkins 2000: 82), KELEKLI (Hawkins 2000: 92-94),

The long-standing debate surroundings the inscriptions of the 'Hartapus Group' has recently gained a renewed attention, following the discovery of a new inscription (TÜRKMEN-KARAHÖYÜK 1, Goedegebuure et al. 2020) attributed to king Hartapu. In this newly discovered stela – found in proximity of the large site of Türkmen-Karahöyük, in the Konya Plain (Massa et al. 2020, Osborn et al. 2020) – the great king Hartapu, son of Mursili, celebrates a military victory against the *Muška* (Goedegebuure et al. 2020). On the basis of paleography, language, and historical contexts, the Türkmen-Karahöyük inscription is dated by Goedegebuure et al. (2020) to the 8th century BCE. The TÜRKMEN-KARAHÖYÜK 1 inscription already generated an important debate in Anatolian studies (Oreshko 2020, Adiego 2021, Hawkins and Weeden 2021). In a recent article, Hawkins and Weeden (2021) accepted the dating of the inscription proposed by Goedegebuure et al. (2020), yet the two authors resist the redating of the entire 'Hartapus Group', arguing for the presence of two kings named Hartapu – respectively ruling in the immediate aftermath of the Hittite Empire and in the 8th century BCE. Regardless of the dating, the inscriptions of the 'Hartapus Group' unequivocally point to the presence in Iron Age southcentral Anatolia of an enduring Late Bronze Age, Hittite, tradition in royal titulary and onomastic.

Within this broader picture characterizing more in general southcentral Anatolia, a degree of continuity between the Late Bronze and the Iron Ages has been reconstructed also for southern

Cappadocia (Mora and d'Alfonso 2012a). This hypothesis is based on four main lines of evidence: (i) the presence of a rich corpus of Iron Age Anatolian Hieroglyphic inscriptions (Tuwana Group; Hawkins 2000: 513-531), which, although of later date (8th century), could be indicative of linguistic and cultural transmission; (ii) continuity in local toponomy, as exemplified by the place names of *Tuwana* (Late Bronze Age *Tuwanuwa*), and *Nahitiya* (Late Bronze Age *Nahita*); (iii) the cult of the Storm God *Tarhunta*, which is rooted in the Late Bronze Age tradition; and (iv) a documented continuity in settlement pattern between the Late Bronze and Iron Ages (Mora 2010, Mora and d'Alfonso 2012a).

Two main sets of textual sources illuminate the history of Iron Age southern Cappadocia, and more in general southcentral Anatolia: the Iron Age Anatolian Hieroglyphic corpus (Hawkins 2000) and Neo-Assyrian cuneiform record (e.g., Bryce 2012). Although at the margin of the Neo-Assyrian power, central Anatolia and its rulers are often mentioned in Assyrian texts dating from the mid-9th to the late 7th century BCE (e.g., Bryce 2012). In the Neo-Assyrian sources, the portion of the central Anatolian plateau roughly corresponding to the Hittite 'Lower Land' (see Section 3.3.1) is defined as the 'land of Tabal', possibly a geographic rather than political label used by Assyrians in order to refer to the Konya Plain, Cappadocia, and the northern foothills of the Central Taurus (Mora 2010: 17-19).

The earliest Assyrian texts referring to Tabal are dated to the reign of Shalmaneser III, informing on a military campaign conducted by the Assyrian king in 836 BCE, which ultimately resulted, according to the Assyrian source, in the submission of the "24 Kings of the Land of Tabal" (Ebeling and Meissner 1938: 433-434). Although filled with the expected rhetoric proper of this textual genre, the Shalmaneser III narrative would support the presence in central Anatolia of a highly fragmented political landscape, possibly based on a number of city-states (Hawkins 2000: 426-427). The dynastic names reported in this text (*Tuatti*, *Kikki*, *Puhamme*) are considered to be of Anatolian origin (Hawkins 2000: 426-427). From this fragmented political landscape, at least two territorial powers emerged in the 8th century BCE: the kingdom of Tuwana and the kingdom of 'Tabal proper'. It is still unclear how a third kingdom ruled by Hartapus would fit this picture, in the eventuality that its dating to the 8th century BCE is accepted (Hawkins and Weeden 2021).

The kingdom of 'Tabal proper' roughly extended in the modern provinces of Kayseri and Nevşehir. This polity corresponds to the *Bit Burutaš* reported in the Neo-Assyrian sources dating to the reign of Sargon II (e.g., Mora 2010: 17). Neo-Assyrian texts indicates in the last quarter of the 8th century a more active involvement of the Assyrian Empire in Tabal. In a document dated to 738 BCE, central Anatolian kings are listed as tributaries of Tiglath-Pileser III (Hawkins 2000: 427). One of these kings, Wassurme (likely the Assyrian spelling of Wasusarma; Bryce 2012: 143) of Tabal, was removed from power by Tiglath-Pileser III (Tadmor 1994: 170-171), inaugurating a policy of direct interventions that continued under Shalmaneser V and Sargon II (Hawkins 2000: 426-428). Following the reign of Sargon II, Assyrian cuneiform sources only tangentially touch upon central Anatolian affairs (Hawkins 2000: 426-428), for then become completely silent after the reign of Aššurbanipal (e.g., Luckenbill 1927: 296-197, 325, 352).

The kingdom of *Tuwana* is a second territorial polity in Iron Age southcentral Anatolia, which is attested in historical sources starting with the 8th century BCE. This polity extended on the classical *Tyanitis*, in southern Cappadocia, with the Bor-Ereğli at his center. The eponym city, *Tuwana*, corresponds to Late Bronze Age toponym of *Tuwanuwa*, identified with classical *Tyana*, today town of Kemerhisar – located ca. 10 km south of Bor, in the northern sector of the plain (Bergens and Nollé 2000). *Tuwana* and its kingdom are only incidentally mentioned in Assyrian sources. Comparatively richer is, on the other hand, the corpus of local Anatolian Hieroglyphic inscriptions. Of particular note is a group of inscriptions associated to a Tuwanean ruler named Warpalawas (Bryce 2012: 150-152). In Neo-Assyrian sources Warpalawas is first attested, under the name Urballa, during the reign of Tiglat-Piles III, in tributaries lists dates to 738 (Tadmor 1994: 68-69) and 732 BCE (Tadmor 1994: 108-109). The latest attestation of Warpalawas in the Assyrian cuneiform record dates to 710-709 BCE, based on his mention in Sargon II letters to the governor of Que (Parpola 1987: no. 1). The length of the reign of Warpalawas appears to have been, thus, particularly long – especially considering the volatile political scenario endemic of central Anatolia. Bryce (2012: 150), following Hawkins (2000: 432-433), suggested that the long reign of Warpalawas could have bene favored by a policy of cooperation with the Neo-Assyrian Empire. It has been also hypothesized (Bryce 2012: 150-151) a possible alliance with the Phrygian Kingdom. The Assyrian and Phrygian influence on the kingdom of Tuwana can be appreciated in the well-known rock relief from Ivriz (IVRIZ 1; Hawkins 2000: plate 292), in which the ruler Warpalawas is represent in a hybrid iconography, combining stylistic features considered of Assyrian, Phrygian, and local origin (Bryce 2012: 150 and therein references).

Warpalawas commissioned three Anatolian Hieroglyphic inscriptions, all found in southern Cappadocia (Figure 4.12): IVRIZ 1 (Hawkins 2000: 516-518), IVRIZ 2 (Dinçol 1994, Hawkins 2000: 526), and BOR (Hawkins 2000: 518-521). We find his name reported also in an inscription of a servant (BULGARMADEN; Hawkins 2000: 521-525), and one belonging to his son and successor to the throne

(NIĞDE 2; Hawkins 2000: 526-527) (Figure 3.12). This epigraphic evidence allows to sketch a tentative dynastic history of the kingdom during the second half of the 8th century BCE. Muwahranis was the father ad predecessor of Warpalawa, as acknowledged in the inscriptions of BOR (Hawkins 2000: 518-521) and IVRIZ 2 (Dinçol 1994, Hawkins 2000: 526). The son and successor of Warpalawas might be also named Muwahranis, on the basis of NIĞDE 2 (Hawkins 2000: 526-527).[14] Two other inscriptions from southern Cappadocia (NIĞDE 1, Hawkins 2000: 513-514; and ANDAVAL, Hawkins 2000: 514-516) were commissioned by Saruwanis, who bears in the ANDAVAL stele the title "ruler, lord of the city of Nahitiya". It is unclear if this figure represents an earlier king in the dynastic line or rather a petty king ruling over the city of *Nahitiya*, likely to be identified with Late Bronze Age *Nahita*, modern Niğde.

Outside southern Cappadocia, a king named Warpalawas is mentioned also in the TOPADA inscription (Hawkins 2000: 451-461), commissioned by the northern Tabalian king Wasuwarma. In the inscription of TOPADA (Hawkins 2000: 451-461), Wasuwarma is mentioned as part of an alliance, which included Warpalawas and two other kings (Kyakya and Ruwanda), against a coalition led by the king of Parzuta. In a new edition (d'Alfonso 2019) it has been proposed a reading of *Prizu*(*wa*)*nda* rather than *Prizuta*, opening to a possible identification of the toponym with the kingdom of Phrygia. D'Alfonso (2019), furthermore, proposed an earlier date of TOPADA, to the 10th/9th century BCE – if this date is correct, the king Warpalawas mentioned in the inscription would represent an earlier ruler than the homonym king documented in the *Tuwana* epigraphic corpus in the second half of the 8th century BCE.

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[14] An alternative dynastic line (Hawkins 2000: footnote 63) could be: Warpalawas I, Muwahranis, Warpalawas II.

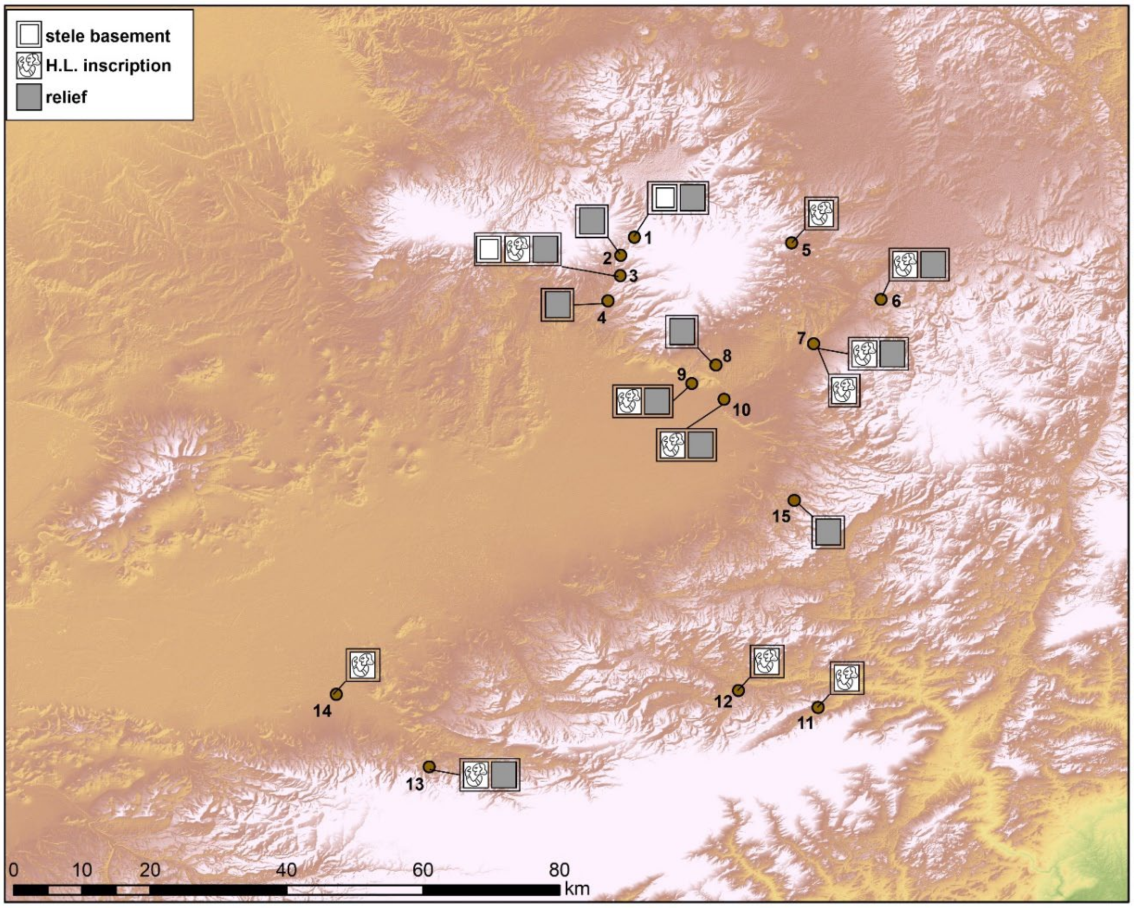

Figure 3.12 – *Iron Age landscape monuments and reliefs from southern Cappadocia: 1, Tavşantepe (stele basement, relief); 2, Tavşantepe 2 (relief); 3, Keşlik (stele basement, relief, inscription CHLI X.51); 4, Dikili Taş (stele basement); 5, Veliisa (inscription CHLI X.49); 6, Andaval (relief, inscription X.42); 7, Niğde 1 (inscription CHLI X.41) and Niğde 2 (relief, inscription CHLI X.47); 8, Beciktepe (stele basement); 9, Bor 2 (inscription); 10, Bor 1 (inscription CHLI X.44; 11, Bulgarmaden (inscription X.45); 12, Porsuk (inscription X.48); 13, Ivriz 1 (relief, inscription X.43), Ivriz 2 (relief, inscription X.46), Ivriz "fragments" (inscription X.50); 14, Ereğli (inscription X.52); 15, Gökbez (relief). Figure realized in ArcMap 10.8.1.*

A final note on the kingdom of Tuwana should be made in regard to local Iron Age cult of the Storm God (*Tarhunzas*) of the Vineyard – a topic on which I will return on several occasions in the following chapters. The Tuwanean rulers directly associate themselves to this deity, via dedicatory or protective inscriptions (e.g., BOR; Hawkins 2000: 518-521) or through iconographic representations (IVRIZ 1, Hawkins 2000: plate 292,294-295; NIĞDE 2, Hawkins 2000: plate 301; KEŞLIK YAYLA, Hawkins 2000: plate 305; The rock relief found at Gökbez, Faydalı 1974; and a more recent stele discovered in proximity of Bor, Ünal 2015). In the latter, the deity is represented holding bundles of wheat with one hand and bunches of grapes with the other, with fruits pending from a grapevine growing behind the Storm God. As we will discuss in following sections of the dissertation, this iconography closely matches the archaeobotanical evidence obtained from the site of Niğde-Kınık Höyük (Chapter 5 and 6), pointing to the centrality of agriculture in the local political economy and cultural-symbolic milieu.

3.3.3 *The Achaemenid period*

As discussed in the previous section, at least starting in the early 8th century BCE, southern Cappadocia represented the core of the post-Hittite kingdom of Tuwana, leaving many unanswered questions: how does this kingdom end? And what happened in the region afterwards? The very poor documentary coverage of the Late Iron Age, due to the end of the local Anatolian Hieroglyphic tradition (Hawkins 2000: 433) and the silence of the Neo-Assyrian sources (Hawkins 2000: 428), makes it very challenging to answer these questions.[15] Complemented by numismatic finds (e.g., Bodzek 2014), the main historical sources at our disposal for this period originate from Greco-Roman authors, who's interest on central Anatolian matters is often restricted to the instances in which the latter incidentally intercept the eastern Mediterranean political history. Herodotus (5th century BCE) is the main source on the annexation of central Anatolia to the Achaemenid Empire (Histories, I). Xenophon (5th/4th century BCE) in the *Anabasis* provides a first-hand account of Cyrus the Younger's revolt and the retreat of his Greek mercenaries throughout Anatolia. A further key source is Cornelius Nepos (1st century BCE), who included in the lives of eminent commanders also the Cappadocian satrap and general Datames (380s/370s–360s BCE) (Cornelius Nepos, *Datames*).

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[15] The issue of the disappearance of the Hieroglyphic Writing in central Anatolia is an open question. As noted by Hawkins (2000: 433), if elsewhere a direct Assyrian control could be seen as major factor determining the disappearance of the script and associated monuments, this hypothesis cannot be applied to the Anatolian Plateau – both on a chronological and historical ground. Hawkins (2000: 433) tentatively proposed that the instable political situation due to Cimmerian rides and the introduction of alphabetic scripts (in Phrygia already in the 8th century) were the two main factors underlying the disappearance of the Anatolian Hieroglyphic tradition in the central Plateau.

According to a tradition transmitted by Herodotus (Histories, 1.71, 72. 76), Cyrus II extended the Achaemenid control over central Anatolia in response to an attack carried out by the Lydian king Croesus, around the 546 BCE. Bordering Phrygia to the east, the kingdom of Lydia represented at the time one of the main political powers in Asia Minor (Payne and Wintjes 2016). Following the Persian conquest, Asia Minor was reorganized in provinces (satrapies), which included: Armenia, Cappadocia, Hellespontine Phrygia, Greater Phrygia, Lydia, Caria, Lycia, and Cilicia (Dusinberre 2013: 33). The borders defining the Asia Minor satrapies are far from being fully understood, due to limited sources and various administrative reorganizations occurring throughout the Achaemenid period (Dusinberre 2013: 33). Similarly limited is our knowledge of the local governors in charge of this administrative organization: our knowledge of Persian satraps is mostly limited to the satrapies located in the western regions of Asia Minor, which are attested more prominently in Greco-Roman sources. It is, thus, not surprising that very little is known regarding the satrapy and the satraps of Cappadocia (Dusinberre 2013: 36-37 and therein bibliography).

Before moving any further into this overview, I should clarify the geographic meaning of the term Cappadocia in the Achaemenid period (see also Section 1.2.5). The satrapy of *Katpatuka*, named by the Greeks as *Kappadocia*, covered a large portion of central Anatolia, extending from the Taurus

Mountains to the Black Sea coast (Strabo, Geography: 12.1-2). The satrapy of Cappadocia, thus, originally covered an area far larger than what it will become the Hellenistic Kingdom of Cappadocia. At a later stage, possibly in order to limit the power of the local satraps, which might have peaked during the government of Datames, the satrapy was split in two: "Cappadocia Pontica" in the north, and "Cappadocia near the Taurus" in the south (Strabo, Geography: 12.1.4). Information on the political history and administrative organization of Achaemenid Cappadocia is extremely limited. In the provincial organization of the Achaemenid Empire, the satrap was responsible of maintaining the order in his province and guarantee the payment of the tribute to Susa. In the specific case of Cappadocia, the tribute appears to have been mostly in form of metal, horses, and livestock (Strabo, Geography: 11.13.8; Herodotus, Histories: 3.90).

In addition to exploiting the mining resources and the agropastoral potential, the latter flourishing thanks to a proliferation of private and temple-owned estates, the province of Cappadocia retained strategic importance due to its position along long-distance trade and communication routes: from Kayseri-*Mazaca* to the Euphrates Valley, via Malatya-*Melitene*, and from *Tyana*-Kemerhisar to Cilicia, via the Cilician Gates (French 1998). This latter itinerary was described by Xenophon (Anabasis), as part of the 'March of the Ten Thousand' (401 BCE) – the expedition of Greek mercenaries hired by Cyrus the Younger. Quoting from Xenophon: "*With the rest of the army Cyrus marched through Cappadocia four stages, twenty-five parasangs, to Dana, an inhabited city, large and prosperous. There they remained three days; and during that time Cyrus put to death a Persian named Megaphernes, who was a wearer of the royal purple, and another dignitary among his subordinates, on the charge that they were plotting against him*" (Xenophon, Anabasis: 1.2.20; from Brownson 1922). The city of *Dana*, where

Cyrus's army stationed for three days before crossing the Cilician Gates, could be identified with the later *Tyana* – i.e., Late Bronze Age *Tuwanuwa*, Iron Age *Tuwana*, modern Kemerhisar (Berges and Nolle 2000: 478-479).[16] If this identification is accepted, the city of *Tuwanuwa-Tuwana-Dana-Tyana* would appear as a major center in the satrapy, hosting high administrative members ("*wearer of the royal purple*") and offices of the Achaemenid administration. *Tyana*, thus, might have retained the former political and economic centrality, extending within and beyond the Bor-Ereğli Plain.

Despite the hypothesized importance of *Tyana* during the Achaemenid occupation, Berges and Nolle (2000: 7-8) emphasized the lack of archaeological evidence from Kemerhisar dated to the Persian and Early Hellenistic periods, likely due to limited investigations and to the presence of later (Roman Imperial and Late Antique) monumental building phases. Lacking archaeological evidence from the main regional political center, it remains extremely challenging to provide an historical outline of southern Cappadocia during Persian rule. A central question concerns the degree of ethnic and cultural impact of the Achaemenid presence in southern Cappadocia. Iranian features are found prominently in the later Hellenistic local tradition (e.g., Panichi 2017) – as well documented in Hellenistic onomastic (Roberts 1963, Mitchell 2007), dynastic genealogies (Diodorus Siculus, *Library of History*: 31.19), and religious-cultic practice (Strabo, *Geography*, XV: 3, 15, Mitchell 2007). This long-lasting Persian influence was, however, very likely intertwined with an enduring central Anatolian cultural tradition. Starting at least as early as the 2nd century BCE, this mosaic cultural landscape will be further enriched by Hellenistic influence, as I will discuss in the following section.

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[16] This identification is based on linguistic and historical ground. It is in fact hypothesize that the Persian name of *Tyana* was *Dana*. The city of *Tyana-Dana*, would have been an urban center, providing the resources needed by the large army of Cyrus the Younger (Berges and Nolle 2000: 478-479). Some scholars, however, proposed alternative identifications – i.e., by proposing to identify *Dana* with the town of *Tunna* (e.g., Williams 1986).

3.3.4 *The Hellenistic period: the kingdom of Cappadocia*

"Apollonius' home, then, was Tyana, a Greek city amidst a population of Cappadocians" (Philostratus, *Apollonius*: I: 4). In the first book of the life of Apollonius of Tyana, Philostratus is informing that the hometown of Apollonius was in all regards a Greek city, yet in a country that was shaped by a local culture. Apollonius is a prime exponent of the Greek cultural milieu, a Neopythagorean philosopher, who's life encompassed the very last years of the Kingdom of Cappadocia. This passage from Philostratus gives us the opportunity to point to three open key issues concerning the Hellenistic period in southern Cappadocia: (*i*) the extent of Hellenization in the region; (*ii*) the degree of persistence of local traditions alongside new cultural orientations; and (*iii*) the relationship between *Tyana* and the broader cultural and ethnic landscape of Cappadocia.

Our knowledge of the political and dynastic history of the Kingdom of Cappadocia originates from Greco-Roman sources (Frank 1966, Panichi 2018). Diodorus Siculus (*Library of History*, XXXI: 19) provides the genealogy of the dynasty of the Ariarathids, from its mythological origin until the reign of Ariarathes V (163-130 BCE). Polybius (Histories, XXIV-XXV; XXXI-XXXII-XXXIII) is an important source on the reign of Ariarathes IV and Ariarathes V, including the dispute between the latter king and his brother/half-brother Orophernes (Panichi 2018: 28-43). Strabo (Geography, XII) is a further key author, writing extensively in the XII book of *Geographica* on political history, economy, and social organization of Cappadocia during the Hellenistic period. Further information can be obtained also in shorter passages from Cicero, Pliny the Elder, and Plutarch (Panichi 2018: VII). If, on the one hand, the epigraphic record is very limited (Roberts 1963, Berges and Nolle 2000), more abundant is the available numismatic evidence (e.g., B. Simonetta 1961, A. M. Simonetta 2007), providing a wealth of information on the Cappadocian dynasties and the political economy of their kingdom.

The end of the Achaemenid satrapy of Cappadocia is connected to the general collapse of the Persian Empire, following the Asian campaign of Alexander the Great. At the time of the "Partition of Babylon" (323 BCE), what remained of the satrapy of Cappadocia appears to have been under the control of Ariarathes, a local nobleman of Persian origins (Diodorus Siculus, *Library of History*, XXXI: 19). Following the Babylonian's agreements, Cappadocia was assigned to Eumenes of Cardia, who overthrown Ariarathes (Diodorus Siculus, *Library of History*, XXXI: 19). A tradition transmitted by Diodorus Siculus (*Library of History*, XXXI: 19), which historicity needs to be cautiously evaluated (Panichi 2018: VII–VIII), indicates that the local dynasty regained the power in Cappadocia with the return from exile of Ariarathes II, son of the former ruler (Diodorus Siculus, *Library of History*, XXXI: 19).

Under the rule of the successor of Ariarathes II, Ariaramnes (ca. 280–230 BCE), Cappadocia obtained a degree of economic and political independence, which was facilitated by the decline of Seleucid power in Asia Minor (Berges and Nolle 2000: 479). In these regards, particularly informative is the coinage dated to the reign of Ariaramnes, in which it is documented the first attestation of coins with Greek legends featuring the toponym of Tyana (Berges and Nolle 2000: 479). We can, thus, reconstruct that Tyana represented the focal center in the formation of the Hellenistic Kingdom of Cappadocia, likely representing at these early stages the main political and economic center (Berges and Nolle 2000: 479-480). Despite the degree of independence obtained by Ariaramnes, Cappadocia remained in all respects under the Seleucid political control, a subordinate alliance that was strengthen by inter-dynastic marriages. The political independence of the Kingdom of Cappadocia appears to have been self-proclaimed by Ariarathes III (225-220 BCE), the successor of Ariaramnes (Panichi 2018: 13). Ariarathes IV *Eusebes* succeeded to his father, holding a very long reign (220-163 BCE). It has been suggested that the flourishing of Cappadocia in the 2nd century BCE, starting with Ariarathes IV reign, might be connected to the rise of the political power of Pergamon, promoting a phase of stability throughout Anatolia (Berges and Nolle 2000: 479). The alliance between the Kingdom of Cappadocia and Pergamon was strengthened by the marriage of the daughter of Ariarathes IV to Eumenes II (Berges and Nolle 2000: 482)

The decline in power of Pergamon and the emergence of the hegemonic power of Rome promoted a period characterized by external political interventions and internal frictions, peaking with the civil war between Ariarathes V *Eusebes Philopator* and Orophernes (Polybius, *Histories,* III: 4). This phase of instability reached an end only following the consolidation of the eastern domains of Rome by Pompey (Berges and Nolle 2000: 480). Cappadocia, thereafter, remained a Roman clientele, ruled by the latest members to the Ariarathids Dynasty, followed by the Ariobarzanes Dynasty (95-36 BCE) (Ballesteros Pastor 2020), and Archelaos (36 BCE – 17 CE) (Michels 2013). With the end of the reign of Archelaos (17 CE), Cappadocia was formally annexed to the Roman Empire. Southern Cappadocia, the Tyanitis, was one of the districts in which the newly established Province of Cappadocia was divided (Berges and Nolle 2000: 487-488). Tyana remained the political and economic fulcrum of the region, as well exemplified by the monumental architecture dated to the Imperial period (Berges and Nolle 2000, and references therein). The prominence of Tyana eventually led to its proclamation to the Roman colony (*Antoniana colonia Tyana*), in the year 213 CE, during the reign of Caracalla (Berges and Nolle 2000: 493).

In the context of this chapter, I have provided only a very brief overview of the local historical trajectory of Cappadocia in Hellenistic times. Despite the limited account, there are several interesting considerations to be made, especially in regard to the cultural and ethnic layout of our study region. Most scholars agree in recognizing the presence of an enduring Persian influence (e.g., Panichi 2017). The Hellenistic kingdom of Cappadocia was ruled by dynasties explicitly claiming Persian noble origins. In addition to onomastic evidence, local rulers were proudly self-proclaiming descendants of some of the noblest Persian families. Well-known in these regards is the case of the Ariarathids family, which is discussed by Diodorus Siculus (*Library of History*: 31.19). The dynasty of the Ariarathids was, in fact, tracking its origin to Cyrus II and to one of the seven Persian who, alongside Darius, defeated the Magus (the "false-Smerdis"; see Herodotus, Histories, III: 61-82), the usurper of the Persian throne (Briant 2002: 97–106). The explicit association of the local rulers to a Persian heritage is evident also in numismatic finds, with Achaemenid iconography in the coins coined during the reigns of Ariaramnes and Ariarathes III (Michels 2017: 50, and references therein). An enduring Persian influence appears to have characterized also the religious and cultic practice of Hellenistic Cappadocia, as most notably testify by the description of fire rituals provided by Strabo (*Geography*, XV: 3, 15) and the discovery of a possible fire-altar in proximity of Kayseri (Karagöz 2007). Thus, although the Achaemenid period remains to date poorly known in Cappadocia, it produced an enduring influence on the local culture and aristocracy.

If the Ariarathids proudly claimed a noble Persian origin, on the other hand they were in all respects fully and actively integrated into the Greek political and cultural koine. According to a later tradition (Berges and Nolle 2000: 493), Ariaramnes was the first local ruler to use the Greek language in Cappadocia. Although this account remains dubious, it should be noted that the first Greek inscribed local coins are dated to his rule (Berges and Nolle 2000: 493). Greek remained, thereafter and until the end of Antiquity, the written language and script of Cappadocia. The earliest Greek inscriptions thus far published are dated to the reign of Ariarathes IV (Berges and Nolle 2000: 480). Of particular note is a dedication to Herakles and Hermes of a gymnasium at Tyana, which supports the presence in the city of a Greek education system (Berges and Nolle 2000: 480–481). Ariarathes IV, himself, studied at Athens, a city in which he was proclaimed an honorary citizen. It is, thus, not surprising that with the reign of this latter king, the penetration of Greek culture into Cappadocia reached a momentum. *Tyana* was the focal cultural point in the process of Hellenization of Cappadocia, we can thus expect that it was interested by monumental building programs – shaping the city, or part of it, in the image of a Greek polis. Unfortunately, the city of *Tyana* remains archaeologically poorly known for the pre-imperial periods. The discovery of a Greek-styled capitellum might, however, corroborate the presence of Greek-styled public architecture (Berges and Nolle 2000: 152).

Berges and Nolle (2000: 12) attribute the political and economic importance of Tyana to its strategic location on long-distance trade routes and to the rich agricultural productivity of the Tyanitis. In addition to the proximity to the Cilician Gates, according to the authors, Tyana offered an "oasis" of Greek-styled urban life in an otherwise rural central Anatolian countryside. This aspect allows us to introduce a further point warranting discussion: the degree of urbanization of Cappadocia and the relationship between Tyana and its broader political landscape. On these aspects, an often quoted and inflated source is Strabo (Geography, XII: 2), who explicitly refer to the presence of only two urban centers in Cappadocia: *Mazaca* (Kayseri) and *Tyana*. It has been already noted how Strabo's definition of *polis*, and its application to the Cappadocian and Anatolian context, is directly dependent on a specific understanding of urban life (Boffo 2000). As I will discuss in the following section of this chapter, the presence of a well-populated and urbanized landscape has been more recently reconstructed on the basis of archaeological evidence (d'Alfonso 2010b), putting at rest the formerly dominant idea of a poorly settled landscape (e.g., Equini Schneider et al. 1997, 101-2, and references therein).

The settlement pattern and economic organization of Cappadocia appears, nevertheless, to have been characterized by features alien to a Greek tradition. Most notably, Strabo discusses the presence of large religious institutions, centered on sanctuaries and controlling extensive agricultural land and labor (*Geography*: XII, 2, 3), possibly reflecting an older local tradition of temples as economic foci. The largest of these institutions was, according to Strabo, the sanctuary of Ma at *Comana*, controlling more than 6000 servants and a large agricultural landscape (Strabo, *Geography* XII: 2, 4). The high priest of *Comana* was, according to Strabo (*Geography* XII: 2, 4), second in the kingdom only to the king himself. Other two large sacred estates were associated to the cult of Zeus: a temple at *Morimene*, among the *Venassi,* controlling a manpower of 3000 servants (Strabo, *Geography* XII: 2, 7), and the *Dacian*[17] priesthood (Strabo, *Geography* XII: 2, 5). Two other important cultic centers in the

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[17] This passage is corrupted. It has been proposed to replace "Dacian" with "Asbamean" (Hamilton and Falconer 1903)

Tyanitis were located at *Castabala* and *Cybista* (Strabo, *Geography* XII: 2, 8). A survival of the local Anatolian tradition is emblematically exemplified by the attestation in the region of *Tyana* up to the Roman period of the personal name Muwatalis – a well-known Late Bronze Age, Hittite, dynastic name (Berges and Nolle 2000: 500).

3.4 Archaeological research in southern Cappadocia and the site of Niğde-Kınık Höyük

3.4.1 *Archaeological research in southern Cappadocia*

In the historical outline of southern Cappadocia, I have emphasized an apparent contrast in pattern characteristic of the region: a dynamic ethnical and cultural is coupled with a remarkable tendency towards continuity in several aspects of the local cultural tradition. In many regards, the Late Hellenistic Period is emblematic of these contrasting tendencies: *Tyana* was a city actively engaged in the Greek cultural koine, nevertheless maintaining defining aspects stemming from the earlier Achaemenid tradition, in a context that remains permeated by the local cultural substratum (section 3.3.4). This aspect of southern Cappadocia is paralleled by a degree of continuity in economic structures: long-distance communication networks, agricultural productivity, and exploitation of metallic ore deposits appear to have been the economic fulcrum of southern Cappadocia throughout its long and eventful history.

Despite the undeniable historical interest in the region, until recent decades southern Cappadocia has remained systematically overlooked by archaeological research. One of the main goals of the Niğde-Kınık Höyük project has been, thus, to provide a new set of archaeological evidence for southern Cappadocia. Before introducing the reader to the site of Niğde-Kınık Höyük (section 3.4.2), in the following paragraphs I will briefly present the archaeological evidence available from the region. In this survey I will not include the Byzantine and Medieval rock-cut settlements, which are characteristic of our study region and more in general of Cappadocia (Bixio 2012, and references therein). A survey of these latter monuments is here considered unnecessary in light of their specific character and late dating.

– *Archaeological surveys*

Southern Cappadocia was visited by several early European scholars, providing the first western accounts on the monuments and ruins therein present (Berges and Nolle 2000: xxii-xxiii, and references therein). The Scottish archaeologists William Mitchell Ramsay published a first detailed description of the Cilician Gates (Ramsay 1903). The scholar, however, did not extent its journey to the nearby Bor-Ereğli Plain. The viability associated to the Cilician Gates was discussed also in the work of John Garstang (1910). Garstang described the road network connecting Konya and Tyana and to the Cilician Gates. Garstang mentioned the presence of visible ancient ruins at Kemerhisar-*Tyana* (1910: 41-42). Of interest for our purposes is the description that the author provides of the landscape surrounding the latter town: "*Owing doubtless to the various fertilising properties of the numerous streams that come down from the hills the whole country is unusually fruitful and productive … . Everywhere are wide acres of corn-land; while in the vicinity of the town are gardens, groves, and vineyards, adding to the attraction which the numerous monuments of antiquity already impart to it*" (1910: 42). Hans Henning von der Osten (1929, 1930) reports a visit to the Roman aqueduct of Kemerhisar-*Tyana* and of the cities of Bor and Niğde – the later city, according to the author, was characterized by the presence of important Seljuk architecture (von der Osten 1929: 37).

Systematic archaeological surveys in southern Cappadocia, and more in general in central Anatolia, took place starting from the 1950s, thanks to large scale projects conducted under the direction of the British Institute in Ankara (Matessi and Tommasini Pieri 2017: 93-95). Although these field projects were mainly focused on the nearby Konya Plain, James Mellaart extended the pedestrian survey also to southern Cappadocia – covering the area between Ereğli and the Cilician Gates (Mellaart 1954) and the districts of Bor and Niğde (Mellaart 1963). Southern Cappadocia was visited also by Piero Meriggi (1962, 1963), during his "*Viaggi Anatolici*". The Italian linguist in 1962 inspected the site of Kınık Höyük (referred by the author as Bayat Höyük) and Kemerhisar-*Tyana*. In the following year, he visited the city of Niğde and the site of Porsuk-Zeyve Höyük. Although Meriggi's work was mostly historically rather than archaeologically oriented, in his reports he provides descriptions of various mounds, including a höyük located on the acropolis of the city of Niğde – currently obliterated by modern buildings.

In more recent years, the southern fringes of the Bor-Ereğli Plain were investigated by the Konya *Ereğli Yüzey Araştırma Projesi* (KEYAR), a project led by Çiğdem Maner (e.g., 2017). More to the south of our study area, on the Bolkar mountains, Aslihan K. Yener directed the *Archaeology of Silver in Ancient Anatolia survey* (ASAA), which identified several sites on the Central Taurus chain, often in association to mining activities (Yener 2000). In this overview, it should be also mentioned two survey projects still awaiting publication: the survey of the eastern slopes of the Melendiz mountain, conducted by Erhan Bıçakçı in 2008 and 2009 (see Matessi and Tommasini Pieri 2017: 94), and Geoffrey Summers' late 1990s survey in Cappadocian, which extended also on the district of Niğde.

It is within this framework that, between 2006 and 2009, a team from Pavia University conducted an archaeological survey in the northern Tyanitis. The survey was directed by Clelia Mora (Pavia University) and Lorenzo d'Alfonso (ISAW-New York University and Pavia University), covering the southern and eastern slopes of Keçiboydurandağ and Melendizdağları mountains and the northern fringes of the Bor Plain (d'Alfonso 2010b, and references therein). This survey project, on which framework originated the archaeological excavation of Niğde-Kınık Höyük, will be presented in Section 3.4.2.

– *Archaeological excavations*

Only a limited number of archaeological excavations took place in southern Cappadocia, hampering our ability to obtain a cohesive view of the local socio-cultural trajectory. To my knowledge, only 7 sites on the Bor-Ereğli Plain and the immediate surroundings have been stratigraphically investigated and published: Porsuk-Zeyve Höyük, Kemerhisar-*Tyana*, Köşk Höyük, the Kaynarca Tumulus, Niğde-Tepebaglari, Bor-Pınarbaşı, and Niğde- Kınık Höyük (Figure 3.13). The latter site will be discussed at length in a specific section of this chapter (Section 3.4.3). As already mentioned, in this survey I am not including Byzantine and Medieval rock-cut settlements (Bixio 2012, and references therein).

The earliest excavations in the region took place at Porsuk-Zeyve Höyük, a site tentatively identified with the Late Bronze Age toponym of *Tunna* (Figure 3.13). Following earlier visits and surveys (e.g., Ramsay 1903: 401-403, Bossert 1954-56), excavations at Porsuk took place uninterruptedly from 1969 until 2001, under the directorship of Oliver Pelon. Field work at the site was resumed, although in discontinuous years, in 2004 under the direction of Dominique Beyer and starting from 2017 of Claire Barat. The site of Porsuk was settled from the Middle Bronze Age to the Roman period, with six main occupation periods so far identified: Porsuk VI (Middle Bronze Age), P. V (Late Bronze Age), P. IV (Iron Age), P. IV and III (Iron Age), P. II (Hellenistic), and P. I (Roman).

Despite being known since the first European accounts (Berges and Nolle 2000: xxii-xxiii, and references therein), archaeological investigations at the site of ancient *Tyana* (Kemerhisar) began at a relatively late date. The first stratigraphic excavations were conducted by Aykut Çınaroğlu (1987), investigating the mound of Ambartepe. Berges and Nolle (2000) conducted a study of the available epigraphic and architectural evidence, without undertake new excavations. Field work resumed in 2001, under the direction of Guido Rosada, who excavated the site until 2013 (e.g., Rosada and Lachin 2012). Starting in 2016, the site has been investigated by a project from the Niğde Archaeology Museum, under the scientific directorship of Osman Doğanay (2019, and references therein). Despite its long occupation history, testified by historical sources, our archaeological knowledge of Kemerhisar-*Tyana-Tuwana-Tuwanuwa* is almost exclusively limited to the Roman and Late Antique period.

Prehistoric levels have been excavated at Kosk Höyük, in the village of Bahçeli, near Kemerhisar. The site – occupied during the Late Neolithic, Chalcolithic, and Roman period – was first investigated by Uğur Silistreli (Ankara University) from 1981 until 1992 (e.g., Silistreli 1991). Excavations at Kosk Höyük resumed in 1996, under the direction of A. Öztan. A long occupation sequences, spanning from the Late Neolithic to the Medieval period, has been exposed at the site of Niğde-Tepebaglari, in proximity to the village of Fertek, about 4 km from the city of Niğde. The site was interested by a short-term excavation in 1972, under the direction of N. Özgüç. To the southwest of Niğde, in proximity of Bor, it is located the site of Bor-Pınarbaşı – occupied during the Chalcolithic, Early Bronze Age, and Iron Age. Following up to earlier survey campaigns, the site was stratigraphically investigated in 1982 by Silistreli (1984). Agricultural works, conducted in 1984, led to the discovery of the funerary tumulus of Kaynarca, about 4 km from Niğde, dated to the transition from the 8th to the 7th century BCE (Akkay 1992).

In the mountain region to the north of the Bor-Ereğli Plain, outside our study region, we should mention the sites of Göllüdağ, Tepecik-Çiftlik, Aşıklı Höyük, and Kömürcü/Kaletepe (Figure 3.13). The Iron Age site of Göllüdağ is located in the village of Kömürcü, 70 km north of Niğde, on the summit of the homonym mountain (e.g., Tezcan 1992, Schirmer 1996). The Late Chalcolithic site of Tepecik, located in the Çiftlik plateau to the east of the Melendiz mountain, has been investigated since 2000 by an Istanbul University project led by E. Bıçakçı. On the banks of the Melendiz river it is located the site of Aşıklı Höyük, representing one of the reference central Anatolia pre-pottery Neolithic sequences (Özbaşaran 2011). Prehistoric evidence, dated to the Lower and Upper Palaeolithic, has been discovered at Kömürcü-Kaletepe (Slimak et al. 2008; see also Kuhn et al. 2015).

On the opposite end of our study area, in the mountains of the Central Taurus, are located the two prehistoric sites of Göltepe and Kestel (Yener 2000) (Figure 3.13). The site of Kestel Cave has been interpreted by Yener (2000) as a tin mine (cassiterite), which may have been in operation as early as the Early Bronze Age (Yener 2000). An Early Bronze Age site, Göltepe, is located on a hillside facing the main entrance of the mine. The site of Göltepe is considered by Yener (2000) as the production center associated to the mining activities conducted at Kestel. Overall, this evidence testifies to the antiquity and importance of mining and metallurgical activities in the Bolkar Mountains – a region rich of polymetallic ores, warranting the extraction of iron (hematite and magnetite), lead, cobalt, copper, and tin (Yener 2000). The exploitation of metallic ores represented, thus, a further pivotal economic aspect of southern Cappadocia and nearby regions, to be added to its strategic position on long-distance communication routes and a rich agricultural potential.

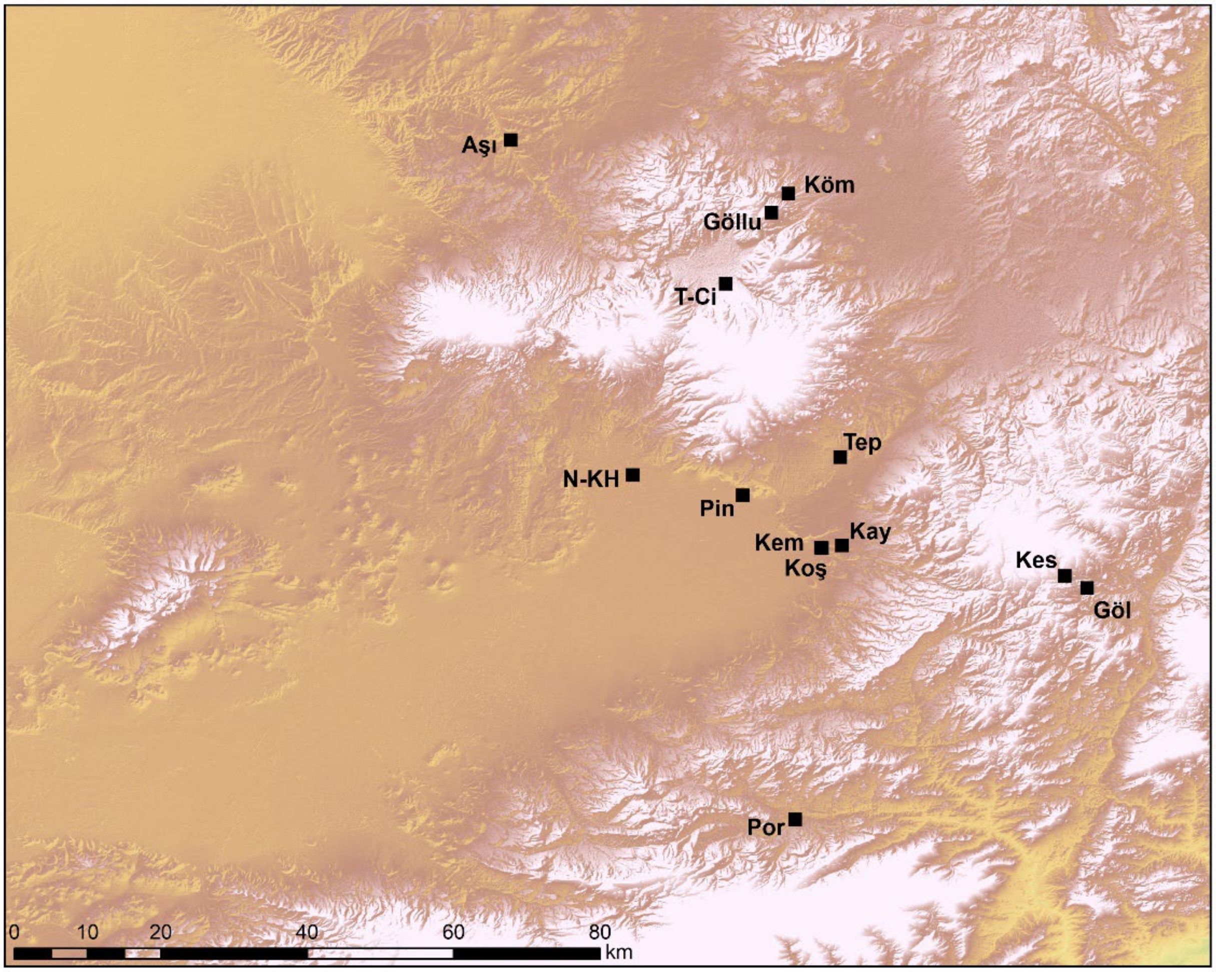
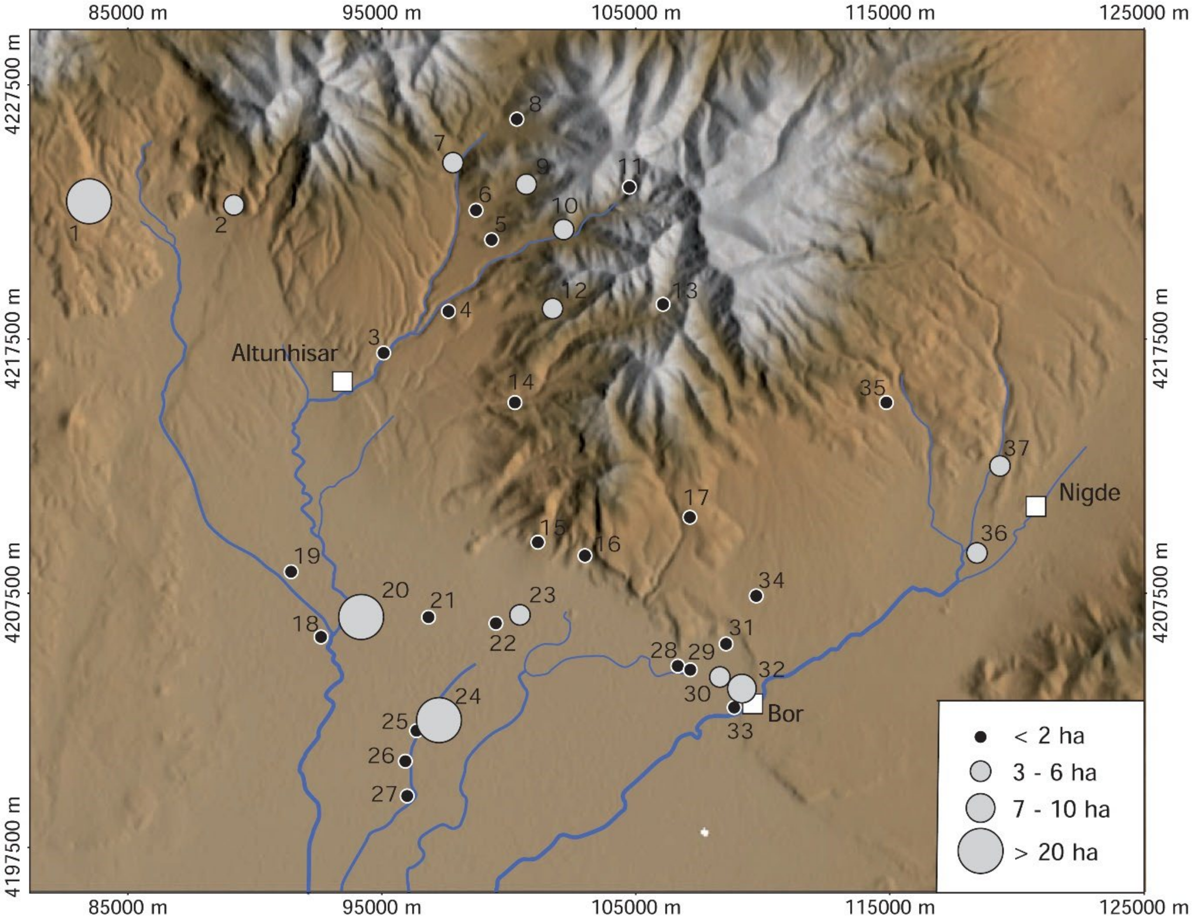


Figure 3.13 – *Archaeological excavations in the Bor-Ereğli Plain and surrounding regions. Abbreviations: Aşı = Aşıklı Höyük; Köm = Kömürcü/Kaletepe; Göllü = Göllüdağ; T-Ci = Tepecik-Çiftlik; N-KH = Niğde- Kınık Höyük; Pin = Bor-Pınarbaşı; Tep = Niğde-Tepebaglari; Kem = Kemerhisar; Köş = Köşk Höyük; Kay = Kaynarca Tumulus; Kes = Kestel Cave; Göl = Göltepe; Por = Porsuk- Zeyve Höyük.*

3.4.2 *The northern Tyanitis archaeological survey*

The Niğde-Kınık Höyük archaeological project stemmed from a survey conducted between 2006 and 2009, under the direction of Lorenzo d'Alfonso and Clelia Mora (Pavia University). Preliminary reports of the survey project were published yearly on the journal *Athenaeum* (d'Alfonso and Mora 2007, 2008, 2009, 2010), while a summary of the main findings is available in d'Alfonso 2010b and Matessi et al. 2016 – the latter two publications are the main references used in this section.


85000 m
95000 m
105000 m
115000 m
125000 m
4227500 m
4217500 m
4207500 m
4197500 m
1
2
3
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6
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18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
Altunhisar
Nigde
Bor
< 2 ha
3 - 6 ha
7 - 10 ha
> 20 ha

Figure 3.14 – *Sites located and recorded during the northern Tyanitis archaeological survey: 1, Avören; 2, Ulukişla Tepesi; 3, Keşlik; 4, Dikili Taş; 5, Kocaçakıl; 6, Kasim-Tepesi; 7, Kilise-öreni; 8, Tavşan-tepe; 9, Bayandır Yayla; 10, Alacayır-yaylası; 11, Asmaz-kalesi; 12, Kırlandı; 13, Karanlıkdere; 14, Tepeköy; 15, Ocaktepe; 16, Üçtepe; 17, Koçlu; 18, Bayat Höyük; 19, Kınık-öreni; 20, Kınık Höyük; 21, Neşet-tepesi; 23, Eskiköy Höyük; 24, Kayı-topraktepe; 25, Ciplaktepe; 26, Sarı Höyük; 27, Taştöme; 28, Azaningolü; 29, Gambigolü; 30, Bor-Pinarbaşı; 31, Gürlelik; 32, Ören; 33, Bağdüzütepe; 34, Baciktepe; 35, Bozduvarlı; 36, Tepebağlari; 37, Kilisedağ.* (*After* Balatti and Balza 2012 *and* d'Alfonso 2010b).

The survey covered the northernmost fringes of the Bor Plain and the southern and eastern slopes of the Keçiboydurandağ and Melendizdağları, encompassing an area of about 800 km². Although the area covered represents a limited fraction of southern Cappadocia, the pedestrian survey focused on a variety of landscape units, from alluvial flatlands to mountain ranges.

The survey was conducted using an "intermediate coverage" strategy, with intensive coverage limited to the area in proximity to major sites. The survey led to the recording of a total of 37 sites, dated from the late Neolithic to the Medieval periods. On the basis of the distribution of surface materials, the recorded sites range from hamlet/farms or strongholds/fortifications (<2 ha; 24 out of 37 sites) to cities (> ha, 3 sites) (Figure 3.14).

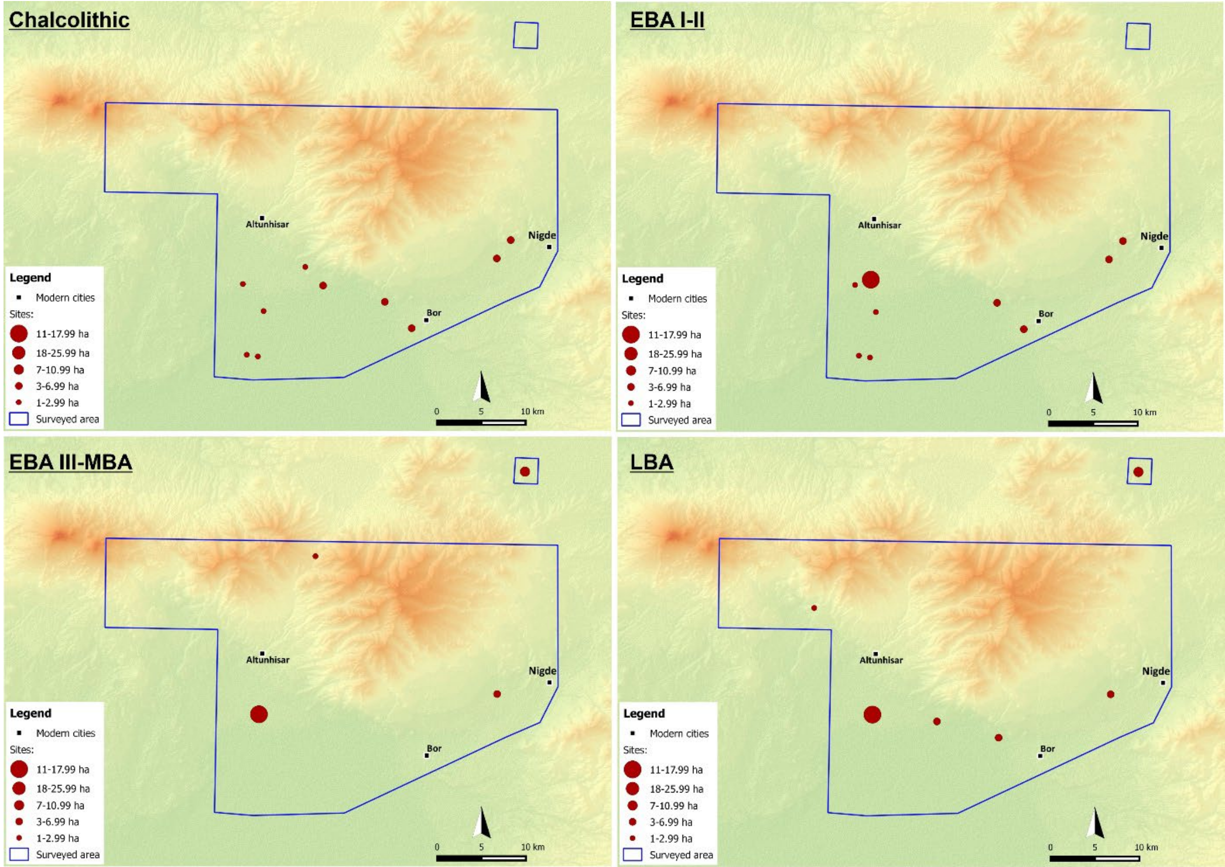

Chalcolithic
EBA I-II
EBA III-MBA
LBA
Altunhisar
Nigde
Bor
Legend
Modern cities
Sites:
11-17.99 ha
18-25.99 ha
7-10.99 ha
3-6.99 ha
1-2.99 ha
Surveyed area
0
5
10 km

Figure 3.15 – *Sites recorded in the northern Tyanitis archaeological survey, from the Chalcolithic to the Late Bronze Age (from* Matessi et al. 2016*).*

Ten sites dated to the Late Neolithic and Chalcolithic have been recorded: six of these sites are very small (< 2 ha) and flat (1 to 5 meters in elevation), four sites are larger (3 to 6 ha) – the dimension of these later sites could be, however, misleading, due to their later occupation (Figure 3.15). Late Neolithic and Chalcolithic sites are located either on the plain floor or on rocky outcrops present at the base of the Melendiz Mountain. The chalcolithic settlement pattern continued into the Early Bronze Age I and II: out of the eight sites attributed to these latter periods, seven were already settled in the Chalcolithic (Figure 3.15). Among the material recovered from the survey, it was not possible to distinguish between the Early Bronze Age III and the Middle Bronze Age, due to strong similarities in ceramic productions between these two periods. The evidence to date available for the EBA III/MBA points to a strong reduction in sites: only two sites are recorded for this period – Tavşantepe (Altunhısar Valley) and Bor-Tepebaglar (Figure 3.15).

An important change in settlement pattern is documented during the Late Bronze Age: the four sites attributed to this period are fairly large in size (three sites between 3 and 6 ha, one – Niğde-Kınık Höyük – more than 24 ha in size). No hamlets or villages are, on the other end, detected. The Late Bronze Age settlement pattern appears to have continued into the Iron Age (Figure 3.16). A hallmark of the Iron Age is the presence of landscape monuments: three or possibly four stelae found in the valley of Yeşilyurt, north of Niğde-Kınık Höyük, possibly marking a route connecting the Bor Plain to the Göllüdağ (Figure 3.12).

In the Hellenistic and Roman periods, archaeologists have recorded a generalized increase in the number of sites (Figure 3.16). Continuity in occupation is recorded for the three largest sites – Niğde-

Kınık Höyük, Niğde-Tepebaglari, and Ulukışla-Hasan Dağ. An important change in settlement pattern is documented starting in the 5th-6th centuries CE, with an intensification of the occupation of the mountainous area (Figure 3.16). In this Medieval phase, settlements vary significantly in size, from small fortresses (Byzantine *Frouria*) and hamlets to villages and small cities (i.e., Avoren in the southern slopes of the Hasan Dağ and Kayı-Topraktepe in the Bor Plain).

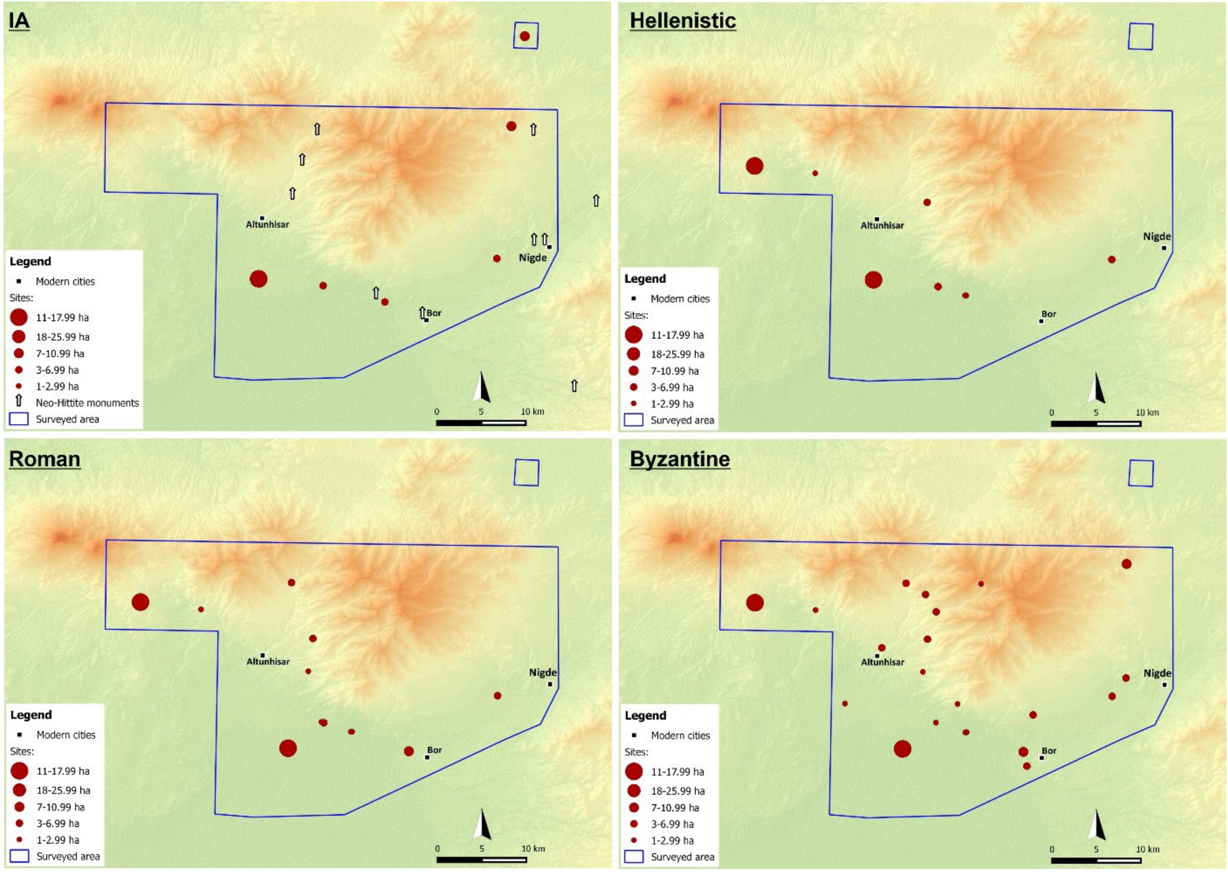

IA
Hellenistic
Roman
Byzantine
Altunhisar
Nigde
Bor
Legend
Modern cities
Sites:
11-17.99 ha
18-25.99 ha
7-10.99 ha
3-6.99 ha
1-2.99 ha
Neo-Hittite monuments
Surveyed area
0
5
10 km

Figure 3.16 – *Sites recorded in the northern Tyanitis archaeological survey, from the Iron Age to the Byzantine period (from* Matessi *et al.* 2016*).*

3.4.3 *Niğde-Kınık Höyük: an introduction to the site and its stratigraphic sequence*

The survey introduced in the previous section (3.4.2) developed into the long-term excavation project of the site of Niğde-Kınık Höyük (Figure 3.17). The ongoing excavation project started in 2011, as a collaborative endeavor of Pavia University (Italy) and the institute for the Study of the Ancient World (New York University, USA), under the direction of Lorenzo d'Alfonso. Annual excavation reports are published in the journals *Athenaeum* (Mora and d'Alfonso 2012b, d'Alfonso and Mora 2013, d'Alfonso, Gorrini, and Mora 2014, 2015, 2016, 2017, 2018, Highcock, Yolaçan, d'Alfonso 2020) and *Kazı Sonuçları Toplantısı* (d'Alfonso 2013, d'Alfonso and Ergürer 2014, d'Alfonso et al. 2015, 2016, 2018, 2019, Ergürer et al. 2017). An introduction to the site, with further bibliography, is provided by Highcock et al. (2015), d'Alfonso and Castellano (2018), Lanaro et al. (2020), and d'Alfonso et al. (2020).

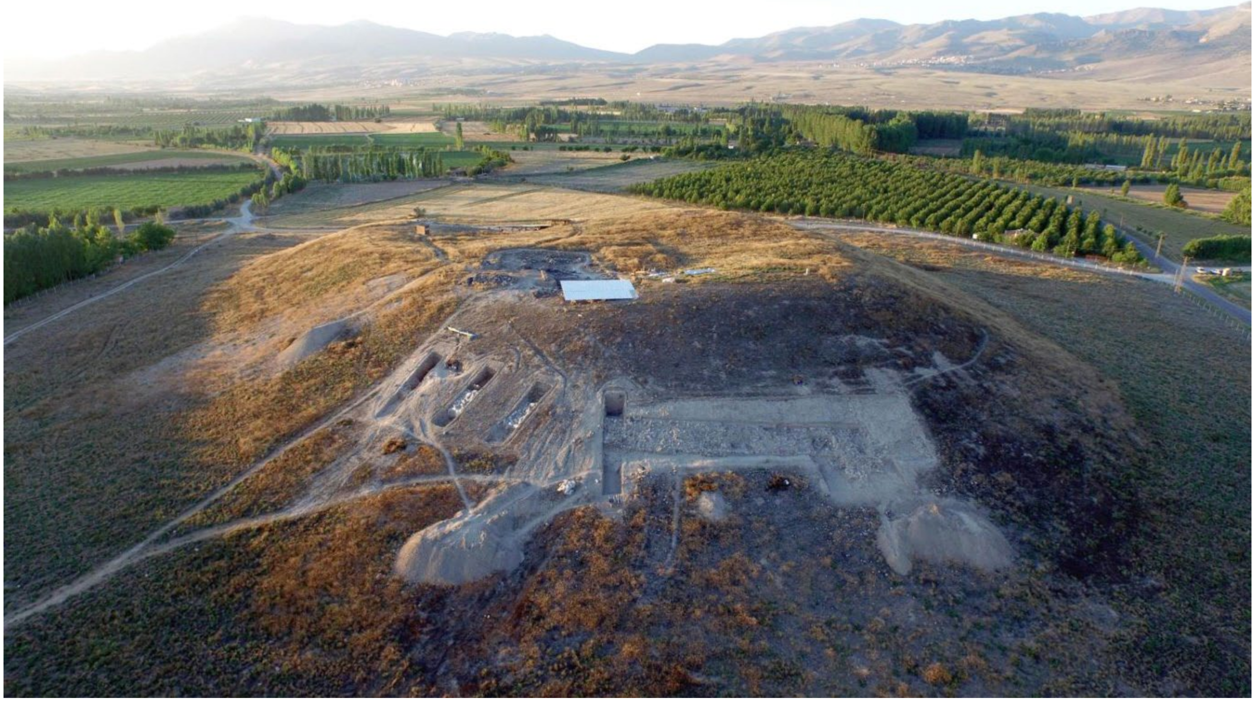


Figure 3.17 – *Drone photo of the site (2015). The photo is taken from south to north: in foreground the archaeological mound with exposed the Iron Age citadel walls (Operation C), in the background Mt. Hasan and Mt. Keçiboyduran. (Kınık Höyük Excavation Project)*

Among the various sites recorded during the survey, Niğde-Kınık Höyük was selected for a long-term excavation project in light of its long occupation history – with surface materials spanning from the Early Bronze Age to the Ottoman periods – and its large dimensions, indicating a first-tier settlement. Furthermore, no modern constructions are present on the mound and in the surrounding terrace, in contrast to other key regional centers such as Niğde-*Nahita-Nahitiya* and Kemerhisar-*Tuwanuwa-Tuwana-Tyana,* which are buried underneath modern cities.

The site of Niğde-Kınık Höyük (37.9373° N, 34.3802° E, 1100 m asl) is located on the northern fringes of the Bor Plain, is an elliptic (180 × 120 m), 20-m-high mound, set on a 9-ha roughly square terrace rising about 2 m from the surrounding plain (Figure 3.17). Survey conducted in the surrounding agricultural fields supports the presence of a large lower town, with an overall estimated settlement size of 24 ha.

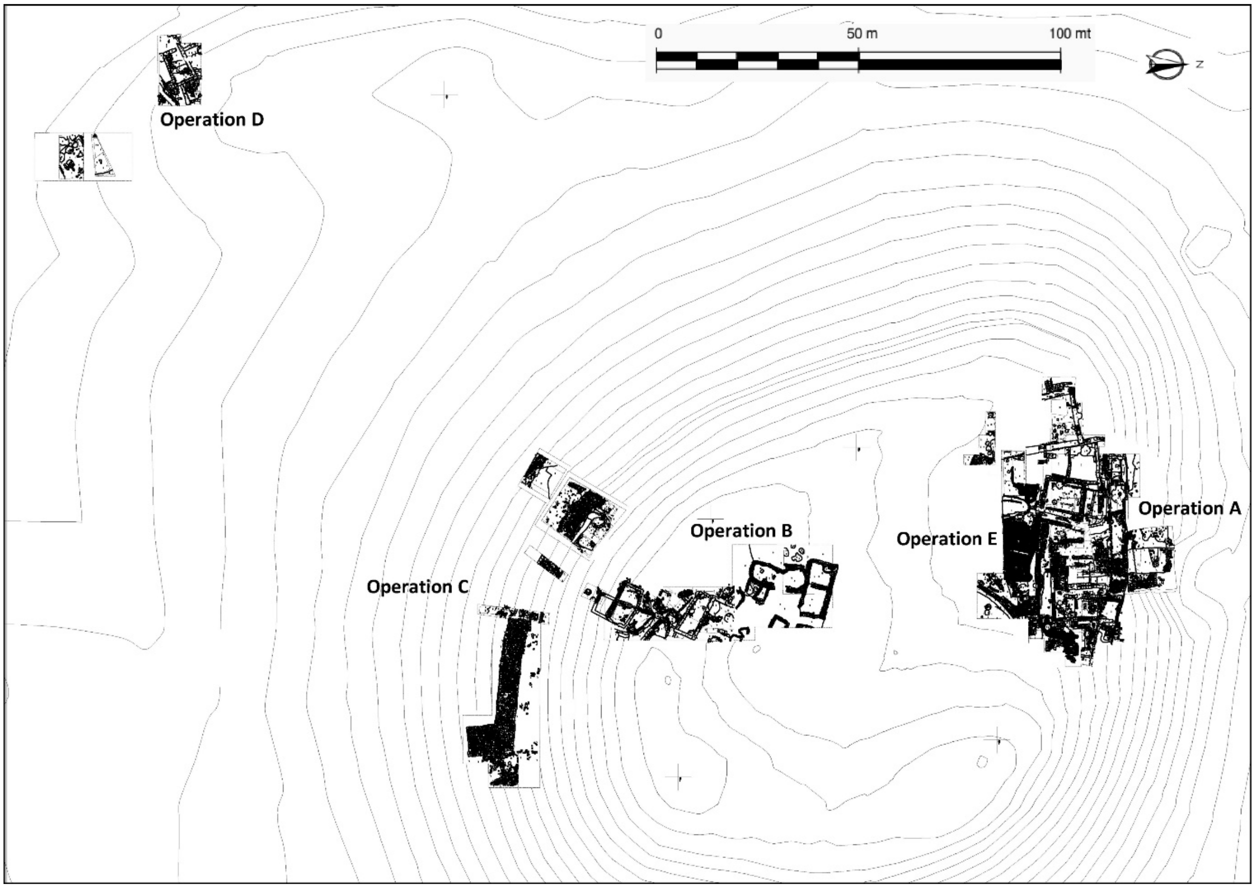
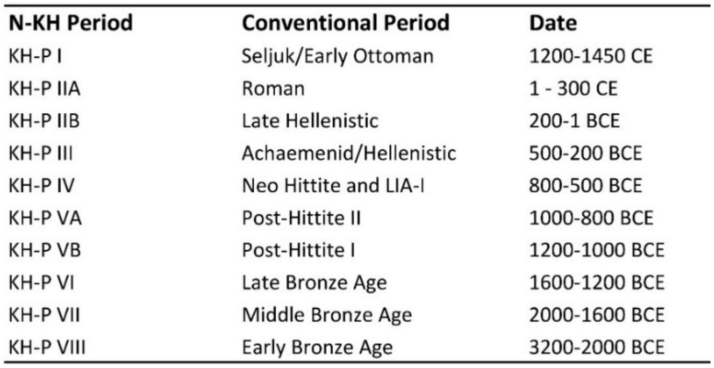


Figure 3.18 – *Topographic plan of Niğde-Kınık Höyük, with indication of ongoing operations (updated at the end of the 2020 field season) (Kınık Höyük Excavation Project).*

The investigation at the site are currently divided into five excavation areas (d’Alfonso and Castellano 2018: 87-88) (Figure 3.18). Operation A is located on the northern slope of the mound, investigating the defensive structures of the mound (Trench Aw), and building complexes to the inside of the citadel (Trenches A1 and A2). Operation A is adjoined to the south by Operation E, focusing on public architecture dating to the Hellenistic and possibly Roman periods. Operation B, divided into Trench B1 (northern sector) and B2 (southern sector), is located on hilltop. Operation C, located on the southern slope of the mound, are under investigation the Iron Age fortifications and a storage area present to the inside of the walls – which will be discussed extensively in Chapter 4. Finally, Operation D (Trenches D1 and D2) investigates the stratigraphy of the lower town.

Stratigraphic evidence supports the long occupation history of Niğde-Kınık Höyük, spanning from the Early Bronze Age to the Ottoman period, with a possible occupation hiatus extending from the Roman to the Seljuk occupation phase (Table 3.1). The stratigraphic sequence, across the different operations, is organized into occupation periods, defined on the basis of comparative stratigraphy of the levels of the different operations (d’Alfonso and Castellano 2018: 88). The absolute dating of the various occupation periods is, furthermore, controlled by means of radiocarbon dating (Table 3.2).



N-KH Period	Conventional Period	Date
KH-P I	Seljuk/Early Ottoman	1200-1450 CE
KH-P IIA	Roman	1 - 300 CE
KH-P IIB	Late Hellenistic	200-1 BCE
KH-P III	Achaemenid/Hellenistic	500-200 BCE
KH-P IV	Neo Hittite and LIA-I	800-500 BCE
KH-P VA	Post-Hittite II	1000-800 BCE
KH-P VB	Post-Hittite I	1200-1000 BCE
KH-P VI	Late Bronze Age	1600-1200 BCE
KH-P VII	Middle Bronze Age	2000-1600 BCE
KH-P VIII	Early Bronze Age	3200-2000 BCE

Table 3.1 – *Periodization of Niğde-Kınık Höyük (updated at the end of the 2021 field season)*

Sample	Lab code	Material type	14C age	68.3% probability	95.4% probability	Period	Level	notes
KIN 13A146s61	LTL21246	Seeds - Vitis vinifera	1821 ± 45	228.5 ± 95.5 CE	218 ± 130 CE	KH-P IIA	A1.1a	
KIN15A1649s60	UBA-30434	Charcoal - Quercus sp.	2101 ± 26 BP	105.5 ± 50.5 BCE	120 ± 76 BCE	KH-P IIB	A1.1	
KIN15A1539s77	UBA-30436	Seeds - Vitis vinifera	2142 ± 41 BP	202.5 ± 142.5 BCE	202 ± 154 BCE	KH-P IIB	A1.1c	
KIN15A1684s117	UBA-30433	Charcoal - Prunus sp.	2178 ± 29 BP	262 ± 89 BCE	241 ± 120 BCE	KH-P III	A1.2	
KIN15A1691s128	UBA-30435	Charcoal - conifer un.le	2248 ± 25 BP	306.5 ± 75.5 BCE	298 ± 92 BCE	KH-P III	A1.2	
KIN15A1893s148	UBA-35998	Charcoal - Quercus sp.	2234 ± 42 BP	292.5 ± 83.5 BCE	286.5 ± 106.5 BCE	KH-P III	A1.3	
KIN15B700s12	UBA-30438	Charcoal - salicaceae	2249 ± 28 BP	307 ± 78 BCE	298 ± 93 BCE	KH-P III	B.5	
KIN15B693s13	UBA-30437	Charcoal - Quercus sp.	2446 ± 36 BP	582 ± 164 BCE	582 ± 173 BCE	KH-P III	B.5	
KIN15D2394s162	UBA-30444	Charcoal - Quercus sp.	2277 ± 39 BP	314 ± 82 BCE	304 ± 98 BCE	KH-P III	D.3d	
KIN15D2358s89	UBA-30443	Charcoal - salicaceae	2210 ± 27 BP	280.5 ± 78.5 BCE	277.5 ± 98.5 BCE	KH-P III	D.4b	
KIN15A1241s71	UBA-36000	Charcoal - salicaceae	2435 ± 29 BP	570.5 ± 154.5 BCE	578.5 ± 171.5 BCE	KH-P IV	A2.4b	
KIN15A1228s53	UBA-35999	Charcoal - Quercus sp.	2458 ± 27 BP	616 ± 134 BCE	586 ± 170 BCE	KH-P IV	A2.4b	
KIN19A3817s2_1	TUBITAK-0766	Grain - Triticum aestivum/durum	2508 ± 43 BP	661 ± 112 BCE	636.5 ± 155.5 BCE	KH-P IV	A2.4d	
KIN19A3869s68_1	TUBITAK-0768	Seeds - Vitis vinifera	2503 ± 28 BP	660.5 ± 107.5 BCE	659 ± 118 BCE	KH-P IV	A2.5	
KIN15C642s21	UBA-30440	Charcoal - Quercus sp.	2464 ± 36 BP	621.5 ± 130.5 BCE	589 ± 172 BCE	KH-P IV	C3.2	
KIN15C2508s4	UBA-30439	Charcoal - Quercus sp.	2472 ± 31 BP	646.5 ± 106.5 BCE	595 ± 173 BCE	KH-P IV	C3.2	
KIN19D3369s193	TUBITAK-0769	Grain - Cerealia	2566 ± 27 BP	780 ± 19 BCE	688 ± 118 BCE	KH-P IV	D2.6b	
KIN19D3338s159	TUBITAK-0770	Grain - Cerealia	3906 ± 29 BP	2404 ± 58 BCE	2383 ± 86 BCE	KH-P IV	D2.8	rejected
KIN19D3357s174	TUBITAK-0771	Grain - Cerealia	3997 ± 29 BP	2519 ± 48 BCE	2520.5 ± 55.5 BCE	KH-P IV	D2.8	rejected
KIN21C3451s38	TUBITAK-1860	1 year old twig	2811 ± 25	963.5 ± 36.5 BCE	973.5 ± 72.5 BCE	KH-P VA?	C3W.3b	
KIN21C3461s60	TIBITAK 1861	1 year old twig	2685 ± 25	850 ± 44 BCE	851.5 ± 48.5 BCE	KH-P VA?	C3W.3b	
KIN14A161s17a	UBA-28267	Charcoal - Quercus sp.	2724 ± 27 BP	863.5 ± 33.5 BCE	865.5 ± 53.5 BCE	KH-P VA	Aw.6	
KIN14A153s18	UBA-28266	Charcoal - salicaceae	2774 ± 37 BP	909.5 ± 69.5 BCE	919 ± 90 BCE	KH-P VA	Aw.6	
KIN14A164s16	UBA-28268	Charcoal - broadleaf in.le	2834 ± 37 BP	986.5 ± 59.5 BCE	1009.5 ± 105.5 BCE	KH-P VA	Aw.7	
KIN15C2524s15	UBA-36002	Grain - Triticum aestivum/durum	2777 ± 30 BP	913 ± 68 BCE	920 ± 86 BCE	KH-P VA	C3.3	
KIN20C4205s8	TUBITAK-1859	1year wood twig	2821 ± 26 BP	969 ± 38 BCE	977 ± 71 BCE	KH-P VB	C4.3	
KIN15C2526s19	UBA-30441	Charcoal - broadleaf in.le	2878 ± 43 BP	1055.5 ± 68.5 BCE	1065.5 ± 137.5 BCE	KH-P VB	C3.4	
KIN15C2543s24	UBA-30442	Charcoal - monocotyledon	2901 ± 35 BP	1085 ± 70 BCE	1101.5 ± 113.5 BCE	KH-P VB	C3.4	
KIN18C3403s43	TUBITAK-0393	Grain - cerealia	2889 ± 27	1065.5 ± 49.5 BCE	1092.5 ± 108.5 BCE	KH-P VB	C3.5	
KIN15A165s55	UBA-36001	Wood - Juniperus sp.	2697 ± 33 BP	853 ± 44 BCE	855.5 ± 52.5 BCE	KH-P VI	Aw.8	rejected
KIN15Aw_wood	UBA-30445	Wood - broadleaf un.le	2769 ± 41 BP	906.5 ± 70.5 BCE	915.5 ± 94.5 BCE	KH-P VI	Aw.8	rejected
KIN13Aw_wood	nr	Wood	3160 ± 50 BP	1449.5 ± 50.5 BCE	1405.5 ± 113.5 BCE	KH-P VI	Aw.8	
KIN19A3880s87_1	TUBITAK-0767	Grain - Hordeum vulgare	3301 ± 30 BP	1572 ± 40 BCE	1566 ± 64 BCE	KH-P VI	pre A2.5	
KIN18C3411s49	TUBITAK-0394	Grain - cerealia	3017 ± 29 BP	1294.5 ± 76.5 BCE	1259.5 ± 130.5 BCE	KH-P VI	C3.6	
KIN18D3260s144	TUBITAK-0395	Charcoal	3009 ± 27 BP	1290.5 ± 79.5 BCE	1256 ± 128 BCE	KH-P VI	D2.5c	
KIN19D3236s207	TUBITAK-0773	Charcoal - broadleaf in.le	2544 ± 29 BP	691.5 ± 100.5 BCE	673.5 ± 124.5 BCE	KH-P VII	D2.6	rejected
KIN19D3245s208	TUBITAK-0772	Charcoal - Quercus sp.	3666 ± 31 BP	2055 ± 77 BCE	2044 ± 97 BCE	KH-P VII	undet.	
KIN18D3279s175	TUBITAK-0396	Charcoal	4180 ± 30 BP	2789 ± 91 BCE	2761.5 ± 125.5 BCE	KH-P VIII	D2.7	

update: 05/12/2021; Calibration software: OxCal 4.4.3; Calibration data set: intCal20

Table 3.2 – *Radiocarbon (AMS) dates obtained from materials samples from Kınık Höyük. Samples were analyzed at CEDAD–University of Salento (Italy) (Lab code: LTL); 14Cchrono center of the Queen's University (Northern Ireland) (Lab code: UBA); and Tübitak MAM (Turkey) (Lab code: TUBITAK). Dates are calibrated using the software OxCal version 4.4 (Bronk Ramsey 2009) using the IntCal20 curve (Reimer et al. 2020). Dates indicated as rejected are considered avulse to the stratigraphic sequence.*

– The Bronze Age evidence: KH-P VIII, KH-P VII, and KH-P VI

The earliest known occupation of the site dates to the Early Bronze Age (KH-P VIII; 3200–2000 BCE). An overview of the currently available Early Bronze Age evidence has been recently provided by Highcock and Matessi (2021). Stratified Early Bronze Age deposits have been to date exposed exclusively in sounding D2, in the lower town terrace (Operation D). The ceramic assemblage of this occupation phase is dominated by handmade Burnished Wares. Single attestations of Anatolian Metallic Ware suggest an EBA I and EBA II date, which is supported by radiocarbon dating (Highcock and Matessi 2021: 281-286) (Table 3.2).[18] Unstratified Early Bronze Age ceramic has been found in comparatively significant amounts in tertiary deposition in later (Iron Age) deposits on the mound slopes (Operation A and Operation C). Although the Early Bronze Age occupation of Niğde-Kınık Höyük still awaits to be exposed in a meaningful extension, available data indicates that during the EBA both slopes of the mound and the surrounding lower town were likely settled. More ephemeral is the evidence dated to the Middle Bronze Age (KH-P VII; 2000–1600 BCE), which is to date limited to a polished, red-slipped drinking cup found in Operation D (Highcock and Matessi 2021: 279-280). Pending further evidence, both the actual presence and nature of the MBA occupation cannot be assessed.

More substantial, although still limited, is the evidence dated to Late Bronze Age (KH-P VI; 1600–1180 BCE). In Operation A, Sector Aw, the earliest exposed phase of the citadel walls has been tentatively dated to the Late Bronze Age (Lanaro et al. 2020, d'Alfonso et al. 2021: 63-64). This dating is, however, based on a single radiocarbon date from a desiccated wood beam found in the masonry, a dating which was impossible to replicate in other specimens due to the copious presence of hyphae (d'Alfonso and Castellano 2018: 89) (Table 3.2).[19] Late Bronze Age deposits have been reached also at the bottom of a deep sounding in Operation C, Trench C3 (d'Alfonso et al. 2019: 472). Although an interpretation of the context is currently hampered by the very limited exposure, a radiocarbon determination originating from a short-lived sample (cereal kernels) returned a Late Bronze Age date (Table 3.2).[20]

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[18] KIN18D3279s175, TUBITAK-0396, wood charcoal, 4180 +- 30 uncal BP, 2776.5 +- 110.5 cal BCE (95.4% probability).

– *The Iron Age evidence: periods KH-P VA, KH-P VB, an KH-P IV*

The Iron Age occupation of the site is divided into three occupation periods: KH-P VB (1200–1000 BCE), KH-P VA (1000–800 BCE), and KH-P IV (800–500 BCE) (Lanaro et al. 2020). A fairly extended exposure of the Iron Age deposits has been possible on the mound slopes, in Operation A (northern slope) and in Operation C (southern slope). Evidence dated to the first half of the 1st millennium BCE has been, more recently, brought to light also in the lower town, (Operation D, Trench D2 and D3). The Iron Age evidence from Operation C, here only briefly summarized, will be discussed at length in chapter 4.

The Iron Age fortifications have been extensively investigated on the norther slope of the mound, in Operation A, Sector Aw (d'Alfonso et al. 2021: 61-66, Lanaro et al. 2020: 216-217). The stone socle of the fortification wall has been exposed for a length of ~ 40 m. The masonry has a width of 4 to

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[19] KIN13Aw_wood, undetermined desiccated wood, 3160 ± 50 uncal BP, 1405.5 ± 113.5 cal BCE (95.4% probability).

[20] KIN18C3411s49, TUBITAK-0394, Cerealia caryopsis, 3017 ± 29 uncal BP, 1259.5 ± 130.5 cal BCE (95.4% probability).

4.5 m, composed by two side walls and a core filled with loose stones and soil. As mentioned in the previous paragraph, the Iron Age walls were constructed on top of an earlier fortification, tentatively dated to the Late Bronze Age. The original mud-brick superstructure was partially preserved only in the easternmost portion of the trench. The outer façade of the wall socle was covered by a mud-plater, preserved for a thickness of ~ 10 cm. At the base of the socle, the plaster joins with a surface, which gently slopes towards the terrace of the site. A radiocarbon date, obtained from a wood charcoal collected from this surface, suggests that the Iron Age citadel walls were already in function at transition between the 2nd and 1st millennia BCE (Table 3.2).[21] The aforementioned outer surface has been subsequently covered by a ~ 2 meters high earthen rampart, erected against the external façade of the walls for defensive and/or static purposes. Two further levels of the rampart were erected at a later stage, testifying the use of the fortification system throughout the Iron Age (Lanaro et al. 2020: 216-217). The deposits to the inside of the citadel walls in the northern portion of the mound are under investigation in Sector A2. The bulk of the Iron Age evidence so far exposed in this area of the site dates to period KH-P IV (800-500 BCE), to which it is attributed a portion of a building, which function – based on building layout and finds – might have been public/representative rather than domestic (Lanaro et al. 2020: 217-218).

The Iron Age stratigraphy on the southern slope of the mound was investigated during Operation C. In 2011, four exploratory soundings (C1, C2, C3, and C4) were excavated (d'Alfonso et al. 2012: 536-537), aimed at the exposing the citadel walls, the presence of which was suggested by geomagnetic survey (d'Alfonso and Mora 2011: 551). After three years of discontinuity, works in Operation C restarted in 2015: a deep sounding was excavated in Sector C3, and the Iron Age walls were exposed in an open area (~30 meters) in Sector Cw (d'Alfonso et al. 2016: 336-337). Excavation in trench C3 continued thereafter, with the sole exception of the 2020 excavation campaign, expanding the trench eastwards and southwards.[22] Since trench 2015 the excavation in C3 has been conducted under my direction (Chapter 4).

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[21] KIN14A164s16, UBA-28268, indeterminate wood charcoal, 2834 ± 37 uncal BP, 1009.5 ± 105.5 cal BCE (95.4% probability).

In Sector C3, evidence dated to period KH-P IV (800–500 BCE) was exposed in a narrow strip (1 to 2 meters) present in the upslope sector of the trench, being these later Iron Age deposits otherwise fully eroded by slope processes. Outside the Iron Age fortification, thick accumulations attributable to period KH-P IV are present on top of an earlier Iron Age rampart. More substantial is the evidence dated to period KH-P VA (1000–800 BCE), to which are attributed two large-scale silos present to the inside of the citadel walls, and an earthen rampart to their outside (see Chapter 4). Evidence dated to period KH-P VB (1200–1000 BCE) has been identified exclusively in a deep sounding. This occupation period is represented in Sector C3 by deposits pre-dating the construction of the exposed phase of the Iron Age fortifications. Considering the paucity of diagnostic materials, the dating of these Early Iron Age levels relies on radiocarbon determinations (Table 3.2).[23] In addition to the evidence from C3, levels attributed to period KHP VB (1200–1000 BCE) have been exposed also in a deep trench excavated in 2020 in Sector

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[22] Excavation in C3 was not possible in 2020 due to the Covid19 pandemic. My participation to the field season was, in fact, not possible due to travel restrictions.

[23] KIN15C2526s19, UBA-30441, broadleaf in.le charcoal, 2878 ± 43 uncal BP, 1065.5 ± 137.5 cal BCE (95.4% probability); KIN15C2543s24, UBA-30442, monocotyledon charcoal, 2901 ± 35 BP uncal BP, 1101.5 ± 113.5 cal. BCE (95.4% probability); KIN18C3403s43, TUBITAK-0393, Cerealia caryopsis, 2889 ± 27 uncal BP, 1092.5 ± 108.5 cal. BCE (95.4% probability).

C4 (d'Alfonso et al. 2021: 71-76).

In recent years, stratified Iron Age evidence has been brought to light also in Operation D, Sectors D2 and D3 (Highcock and Matessi 2021: 280-281). The Iron Age deposits from the lower town to date detected are highly disturbed by extensive pitting activities. Nevertheless, it has been possible to preliminarily reconstruct the presence of two construction phases, characterized by stone and mud-brick walls and various pits, tentatively dated respectively to period KH-P VA (1000-800 BCE) and KH-P IV (800-500 BCE) (Highcock and Matessi 2021: 280-281). The recently concluded 2021 excavation campaign allowed to expose a more articulated architecture, encompassing a portion of a building, an alley, and a monumental stone wall – the latter possibly part of an outer fortification system.

– *The Achaemenid, Hellenistic, and Roman evidence: periods KH-P III and KH-P II*

The second half of the 1st millennium BCE is represented at Niğde-Kınık Höyük by two occupation periods: KH-P III, attributed to the Achaemenid/Early Hellenistic period (500–200 BCE); and KH-P IIB, attributed to the Late Hellenistic period (200–1 BCE). A Roman occupation phase, KH-P IIA (1–300 CE) has been recently detected, dismissing an earlier hypothesis that the site was abandoned at the end of the Late Hellenistic period (e.g., Highcock et al. 2015: 99).

KH-P III (500-200 BCE) is attributed to a large building exposed in Operation A, Sector A1. Both the dimensions and layout of the building reasonably exclude domestic functions. To the contrary, this building has been interpreted as part of a sanctuary, as further corroborated by the presence of highly distinctive materials – including zoomorphic statuettes, figurines, and vessels (d'Alfonso et al. 2020: 28). KH-P III deposits have been exposed also in Operation B, on the mound top, where a portion of a building dated to this period has been brought to light (Highcock et al. 2015: 112-114). Due to the limited area of exposure, the function of this building cannot be safely reconstructed.

The Late Hellenistic period (KH-P IIB) has been extensively exposed during Operation A, where a large terrace storage area, hosting a number of pithoi, was built on top of the aforementioned period KH-P III architecture (d'Alfonso et al. 2020: 25-26). In an adjoining excavation trench (Operation E), a stone-paved plaza has been exposed (d'Alfonso et al. 2020: 26-28), representing a public space in function throughout the last centuries of the 1st millennium BCE. The cultic function of the area, continuing the previous tradition, is corroborated for this period by the presence of a Greek inscription mentioning the god Zeus, a marble eagle statue, and a number of terracotta bovine figures, including fragments of close-to life size statues (d'Alfonso et al. 2020: 27). Operation B during the Late Hellenistic occupation (KH-P IIB) appears to have contained mixed residential and production areas (Highcock et al. 2015: 112-114). Furthermore, a portion of a domestic building attributed to KH-P IIB was exposed in the lower town (Operation D, Sector D1), build on top of an earlier (KH-P III) construction phase (Highcock et al. 2015: 115-117).

In recent years, a Roman occupation phase (KH-P IIA) has been documented in Operation A (Sector A1) and possibly in Operations E. The chronology of this phase is corroborated by radiocarbon dating (Table 3.2).[24] A discussion of the Roman occupation of the site is to date hampered by its limited exposure.

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[24] KIN 13A146s61, LTL21246, *Vitis vinifera* seeds, 1821 ± 45 uncal BP, 218 ± 130 CE cal. BCE (95.4% probability).

– The Seljuk/Early Ottoman evidence: period KH-P I

The available evidence points to an occupation hiatus of the citadel extending from the Roman/Late Roman period to the Seljuk and Ottoman habitation phases (Period KH-P I; 1200–1450 CE). No evidence of Late Antique occupation is known to date from the mound, although Early Byzantine surface materials are found in the lower town (d'Alfonso and Castellano 2018: 88). Substantial evidence dated to KH-P I is currently limited to Operation B (Highcock et al. 2015: 112-114). Considering the poor architectural configuration—pit-houses and animal enclosures—this phase is interpreted as a modest village (d'Alfonso et al. 2017, Highcock et al. 2015), possibly a seasonal campsite.

3.4.4 The Niğde-Kınık Höyük project: perspectives and main research questions

After eleven excavation campaigns, several research lines emerged from the Niğde-Kınık Höyük project. In addition to providing stratified data from an archaeologically overlocked region, the research at Niğde-Kınık Höyük is structuring around some defined research questions, which will be here only briefly summarized, leaving to the referenced literature a more in-depth discussion.

The exposure in 2018 in Operation D of Early Bronze Age strata opened to a new research avenue focused on this earlier period, with a more specific interest in the occupation of the lower town (Highcock and Matessi 2021). It is aim of future campaigns to further expose these levels in order to better understand the nature of the occupation and the urbanistic layout of the Early Bronze Age settlement.

The excavation project at Niğde-Kınık Höyük began with an explicit emphasis on the study of the transition from the Late Bronze Age to the Iron Age, a topic first discussed in relation to the site by

Mora and d'Alfonso (2012a) (Section 3.3.2). Although Late Bronze Age levels have been since then exposed only at the bottom of deep soundings, due to the presence of thick later deposits, in more recent years new evidence on this topic has been collected (d'Alfonso et al. 2021, and therein references). It remains a goal of future excavation seasons to expose to a larger extend the Late Bronze and Early Iron Age occupation, aiming at better defining the local socio-cultural and historical dynamics occurring during this transitional period. The excavation of the Middle Iron Age levels, on the other hand, is providing insights on the material culture associated with the Kingdom of Tuwana (e.g., Lanaro et al. 2020) (Section 3.3.2).

The Achaemenid and Hellenistic occupation of the site represents a further pivotal avenue of research at Niğde-Kınık Höyük. Considering the general paucity of evidence from Cappadocia dated to the Achaemenid period, stratified data from Niğde-Kınık Höyük might allow to better understand the local material culture and the degree of Persian influence (Trameri and d'Alfonso 2020) (Section 3.3.3).

Both the Achaemenid and Hellenistic occupations have been extensively exposed in connection to cultic activities, leading to a possible identification of the site as a "Sacred City" (e.g., d'Alfonso et al. 2020, Trameri and d'Alfonso 2020) (Section 3.3.). An investigation of the Late Hellenistic deposits, furthermore, will allow to assess the degree of Hellenization of the region and the underlying socio-cultural processes (d'Alfonso et al. 2020).

The case studies presented in the following chapters (4, 5, 6) will directly contribute to these general research questions.

3.5 Summary

In Chapter 3, I introduce southern Cappadocia. This region corresponds to the Bor-Ereğli Plain and the foothills of the surrounding mountains – the Central Taurus and the southern slopes of Cappadocian Volcanic Complex (Section 3.1.1). Although climatic conditions are semi-arid (Section 3.1.2), southern Cappadocia is characterized by the presence of several humid environments, the presence of which is connected to the local hydrographic setting. Paleoenvironmental research has allowed scholars to reconstruct the complex history of advances and retreats of these humid ecosystems throughout the Late Pleistocene and the Holocene (Section 3.1.3). A higher water availability, if compared to other regions of central Anatolia, has favored the presence of a thriving agricultural economy (Section 3.2). The Graeco-Roman name of the region, *Tyanitis*, originates from the most important urban center therein present: the classical city of *Tyana* (modern Kemerhisar) (Section 3.3). Attested with the toponym of *Tuwanuwa*, this city emerged as the main regional political center in the Middle and Late Bronze Age. Starting at least from the 8th century BCE, the Bor-Ereğli Plain emerged as the core of the post-Hittite polity of *Tuwana*. *Tyana*-Kemerhisar likely maintained its hegemonic status also in the Achaemenid period. During the Hellenistic period, the city of *Tyana* became a prime center of Hellenization. Southern Cappadocia has been long overlocked by archaeologists (Section 3.4). The long-term excavation project at Niğde-Kınık Höyük (Section 3.4.3) aims to fill this gap. The site, located in the northern fringes of the Bor Plain, is an elliptic (180 × 120 m), 20m-high mound. Survey conducted in the nearby agricultural fields supports the presence of a large lower town. The site was occupied from the Early Bronze Age to the Seljuk/Ottoman period, with a possible occupation hiatus in the Late Antiquity.

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Having provided in this chapter a due introduction to southern Cappadocia, in the three chapters that follow, I will present the results of the archaeological (Chapter 4) and archaeobotanical (Chapter 5 and 6) study conducted at Niğde-Kınık Höyük. This research is aimed at reconstructing the southern Cappadocian agricultural landscape in the late 2nd and 1st millennia BCE: in which way the environmental conditions characteristic of southern Cappadocia impacted the local agricultural systems and more in general economic structure? And how these activities impacted the local vegetation history? Which changes are recorded in the agricultural system throughout the eventful local and regional historical trajectory? Under which modalities the site of Niğde-Kınık Höyük participated in the local agricultural landscape?

CHAPTER 4

The Iron Age granaries from the southern slope of Niğde-Kınık Höyük: Agricultural infrastructure in post-Hittite Anatolia:

In the previous chapter (Chapter 3), I introduced southern Cappadocia and the archaeological site of Kınık Höyük. The latter site is understood as an active component of a broader cultural landscape. Kınık Höyük is the focus of this part of the dissertation (Part II), which is aimed at reconstructing southern Cappadocian agriculture in the late 2nd and 1st millennia BCE. In order to achieve this goal, I will start by presenting the archaeological evidence originating from the Niğde-Kınık Höyük (this chapter), which will be followed (Chapters 5 and 6) by the archaeobotanical study.

More specifically, in this chapter I focus on the Iron Age large-scale storage facilities recently brought to light on the southern slope (Operation C) of Kınık Höyük. Storage is a central aspect of ancient agricultural systems, representing an activity ultimately connected to the economic and institutional organization of production, extraction, and redistribution/consumption of agricultural staples. Although of undoubted interest, a comprehensive discussion of crop storage practice throughout the occupation history of the site is outside the scope of the dissertation project. Various forms of medium and small-scale storage (e.g., small silo-pits or vessel storage) are ubiquitously attested in the archaeological deposits, reflecting the expected presence of a wide array of storage strategies, purposes, and actors. Leaving to future research a general analysis of storage activities at Kınık Höyük, in this chapter, I will concentrate on the evidence of large-scale storage dating to Period KH-P VA (c. 1000-800 BCE). After an introduction to the stratigraphic sequence exposed in Operation C, Sector C3

(Section 4.1), I will present the archaeological evidence of large-scale granaries (Sections 4.2.1, 4.2.2, 4.2.3), for then discussing the technology of underground storage (Section 4.2.4), and finally providing a discussion of the evidence from Kınık Höyük in the broader Siro-Anatolian context (Section 4.3).

This first case study included in the dissertation allows me to reconstruct the presence at the site of Niğde-Kınık Höyük during Period KH-P VA (1000-800 BCE) of an institution interested and capable of extracting and accumulating large quantities of agricultural products, which hints to the existence of a surplus-oriented, centralized, form of agricultural production orbiting around the site. In addition to directly informing on administrative and economic aspects of the early 1st millennium BCE southern Cappadocian agricultural system, I will propose that this evidence could be seen as indicative of a possible degree of regional continuity in economic structures between the Hittite and post-Hittite periods.

The evidence presented in this chapter originates from archaeological field work that I have conducted at Niğde-Kınık Höyük from 2015 to 2021, directing the excavation in Sector C3.[25] A detailed description and discussion of the Iron Age storage infrastructures from Niğde-Kınık Höyük has been already fully published (Castellano 2018). Passages from Sections 4.2, 4.3, and 4.4 are quoted verbatim from the latter publication, which originated in the framework of the dissertation project. For a general introduction to the site of Niğde-Kınık Höyük, I refer to Chapter 3.

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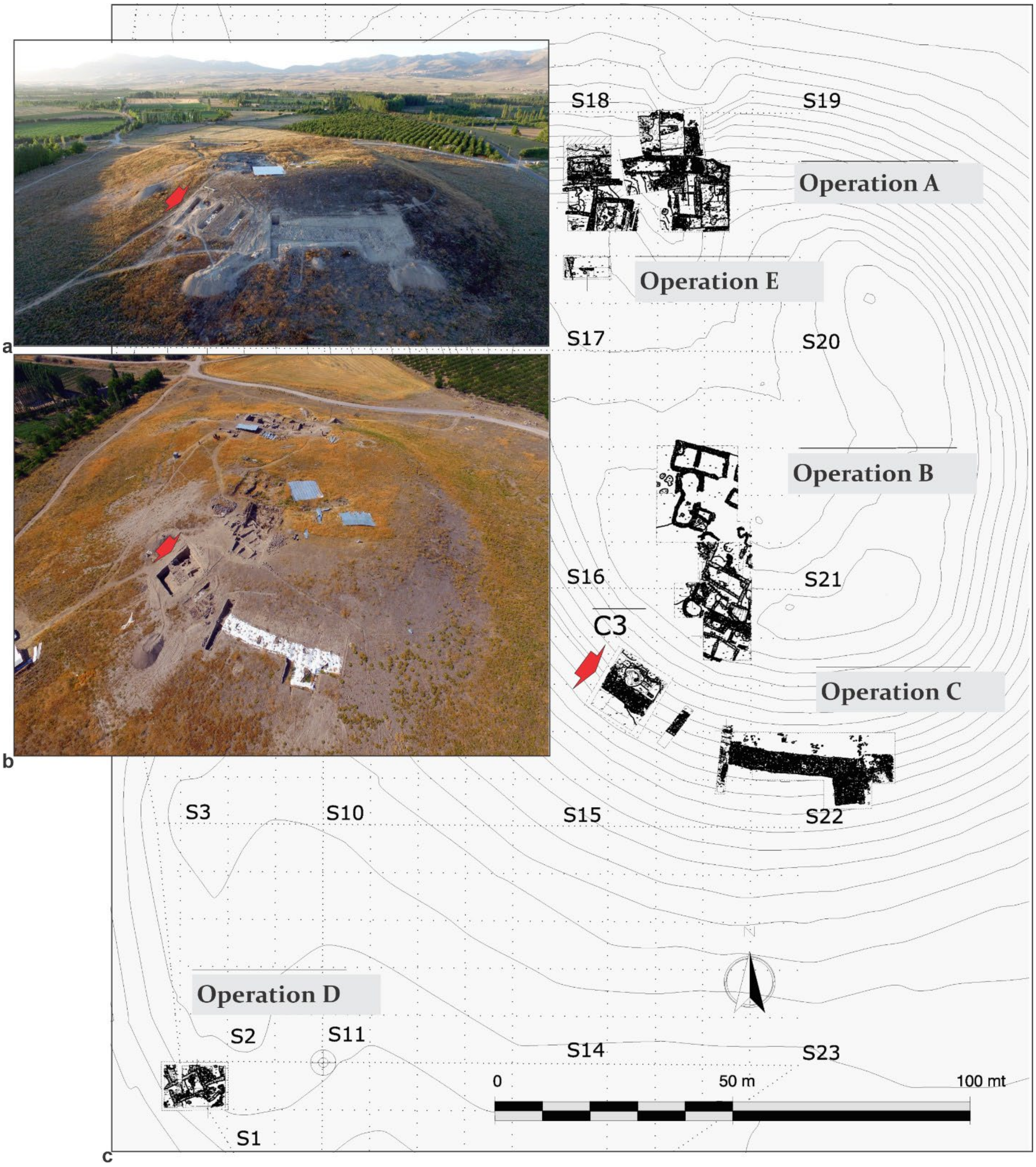
[25] Travel expenses associated to field work were supported by ISAW travel grants (2016-2019 and 2021), Antonina S. Ranieri Fund Grant (2016), and P.E. MacAllister Fellowship-ASOR (2015). In field work I was assisted by graduate (P. Strosahl in 2016, E. Dalkilic in 2017) and ungraduated (A. Guney in 2021) students. I am thankful to local Turkish workers, who facilitated the logistic of the work. I am especially grateful to Mr. I. Mercan, with whom I worked from 2015 to 2021.

4.1 Niğde-Kınık Höyük, Operation C: excavations on the southern slope of the mound

Operation C is located on the southern slope of the mound of Niğde-Kınık Höyük (Figure 4.1). Elevations in this sector of the site range from 1219/1220 m asl (mound top in Operation B) to 1199/1200 m asl (base of the slope). The altimetric profile is determined by slope dynamics, with important erosive processes affecting the areas located in the upper part of the slope, and the resulting colluvium accumulating more downhill and at the base of the slope.

The mound of Kınık Höyük – including its southern slope – is fully encircled by Iron Age citadel walls. These defensive structures were first documented by geomagnetic prospections conducted in 2010, prior to the beginning of the excavation project (Mora and d'Alfonso 2012b: 57-58). In light of the results of the geophysical survey, during the first excavation season (2011) four test trenches (ca. 2x10 m) were opened on the southern slope of the mound; these soundings are referred to as C1, C2, C3, and C4 (Matessi et al. 2014: 326-328). The 2011 soundings confirmed the presence, few decimeters underneath the modern surface, of the stone masonry of the Iron Age citadel walls. The presence of Iron Age structures just underneath the modern surface is due to the important erosive processes occurring on the slope. Likely these processes completely eroded in this area of the site the post-Iron Age portion of the archaeological deposits. The thick Hellenistic (KH-P IIB, 200-1 BCE) and Achaemenid (KH-P III, 500-200 BCE) occupation sequence exposed in the nearby Operation B, on the hilltop, were in fact not identified in Operation C. Only in recent years, in the lower portion of the slope, were Hellenistic structures (KH-P IIB) identified (Section 4.1.1). In light of the presence of Iron Age deposits at the top of the stratigraphic sequence, Operation C offered the possibility of extensively investigating these levels, which are otherwise generally buried elsewhere on the site under meters of later deposits.


a
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S2
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S14
S23
0
50 m
100 mt
S1
c

Figure 4.1 – (*a*), *aerial view of Niğde-Kınık Höyük at the end of the 2015 campaign, from south to north. In the foreground the southern slope of the mound (Operation C)*; (*b*), *drone photo at the end of the 2017 campaign*; (*c*). *General plan of the site with indication of the excavation areas. In all panels, the red arrow indicates Sector C3-Operation C. Photos and plan by Kınık Höyük Project.*

After the 2011 field season, excavations via Operation C were suspended until 2015 – resuming in concomitance to my involvement in the project. In the 2015 campaign two main areas were under investigation in Operation C: (*i*) in the easternmost portion of the operation, under the direction of dr. Anna Lanaro, the citadel walls were exposed in a new open-area trench (~40 m); and (*ii*) under my direction excavation was resumed in the westernmost of the four 2011 test trenches – i.e., sounding C3 (d'Alfonso et al. 2016: 336-337) (Figure 4.2).

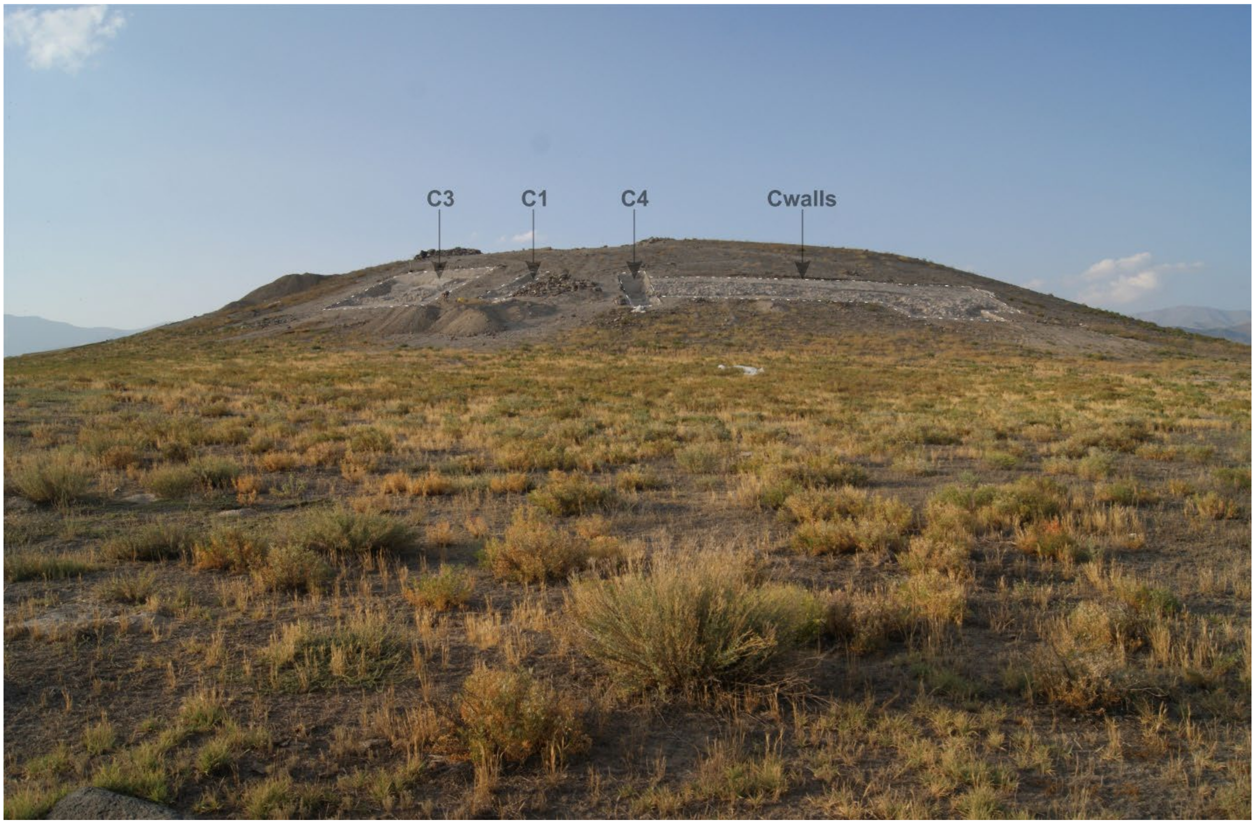


Figure 4.2 – *Operation C at the end of the 2015. On the right side it is possible to notice Sector Cwall, in which the Iron Age citadel walls have been exposed over a length of more than 40m. On the left side, the squared excavation area is Sector C3. In between the two area are visible the 2011 C1 and C4 soundings.*

Taking advantage of the preexisting trench, the main aim of the 2015 campaign in Sector C3 was to expose the earlier Iron Age occupation of the site and to clarify both the chronology and phasing of the citadel walls in this sector of the mound. In addition to exposing the thick Iron Age stratigraphic deposits; in the 2015 C3 deep sounding we intercepted a first large-scale underground silo (Structure C2522; Section 4.2.1).

The positive results of the 2015 campaign prompted us to further enlarge the excavation area during the following 2016 season. The trench limits were extended by 9 m towards southeast, ultimately connecting the 2011, C3 and C2, soundings into a single excavation area of roughly 12x14 m. Within these excavation limits, in the 2016 (Ergürer et al. 2017: 592-594), 2017 (d'Alfonso et al. 2018: 577-579), and 2018 (d'Alfonso et al. 2019: 470-472) excavation campaigns, we exposed the southeastern limit of the silo – Structure C2522 – and a portion of a second granary adjoining to it (Structure C2884; Section 4.2.2).

Because of logistics and safety concerns, starting from 2019 excavations in Sector C3 concentrated on the deposits present to the outside of the citadel walls, which investigation already started in 2017 (d'Alfonso et al. 2018: 579). During the 2019 excavation season, the 2017 trench limits were extended 8 meters further downslope (Highcock et al. forthcoming).

Following the original 2011 trench numbering, the resulting excavation area is named, in the literature and in this dissertation, as Sector C3. In order to facilitate the stratigraphic phasing, the sector is divided into two tranches: Trench C3E, upslope of the citadel walls; and Trench C3W, downslope of the walls (Figure 4.3). As I will discuss in the next paragraphs, the two trenches are characterized by a very different depositional and post-depositional history, reflecting their location respectively within and outside the limits of the citadel.

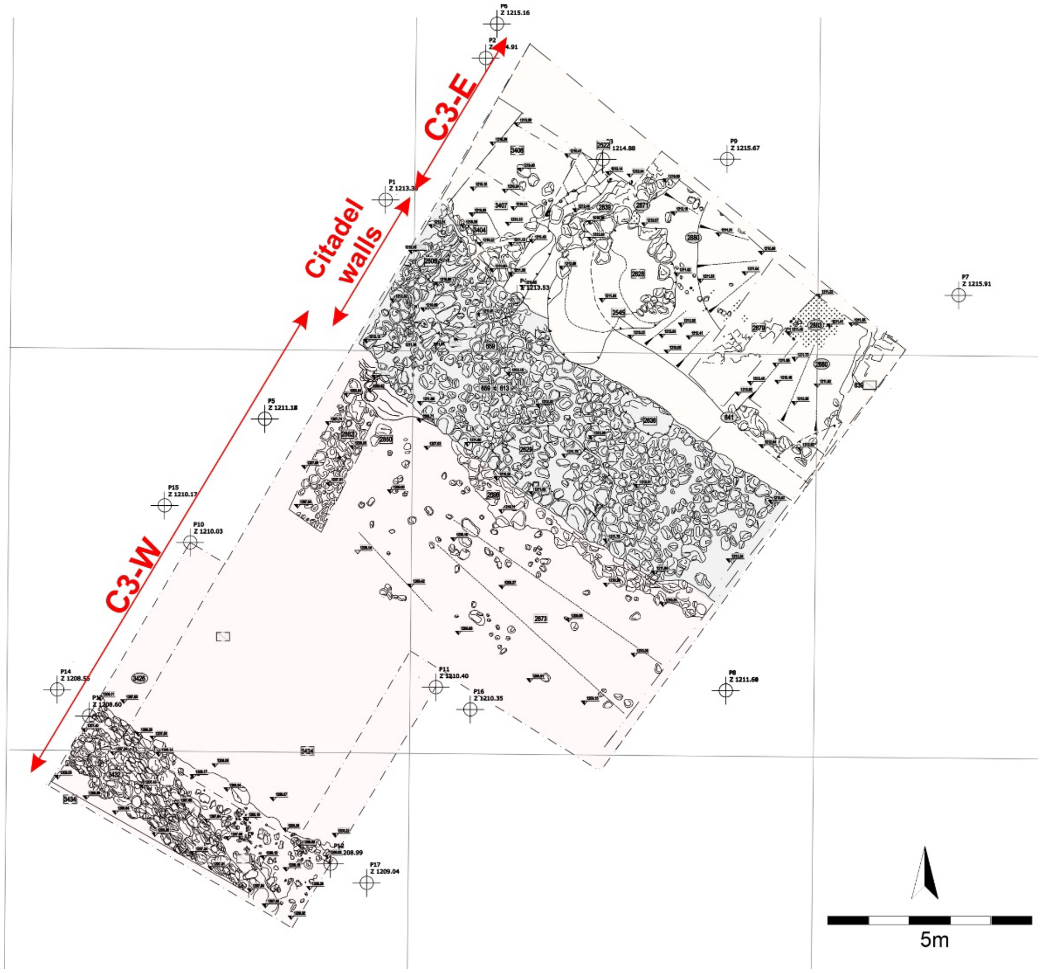


Figure 4.3 – *Operation C, Sector C3, final plan at the end of the 2020 campaign. To be noted the location of the Iron Age citadel walls and of the trenches referred as C3W and C3E. The stones present in the northwestern corner of Trench C3W, in proximity to the citadel walls, are exposed at the bottom of a deep sounding.*

4.1.1 *Operation C, Sector C3: the stratigraphic sequence*

It is outside of the scope of this dissertation to provide a detailed account of the stratigraphic sequence from Operation C, Sector C3. In this section I will, thus, only briefly summarize the occupation sequence, in order to better contextualize the evidence of large-scale granaries on which this chapter concentrates. I shall, furthermore, remark that at the time of writing, field work is still ongoing. The following phasing is, thus, to be considered as preliminary, especially in regard to the earlier levels, which are the main focus of ongoing excavations. As mentioned in the previous section, Sector C3 can be divided into two trenches: C3E (uphill the citadel walls) and C3W (downhill the citadel walls). In the following paragraphs, I will introduce to the stratigraphy of the two areas separately, for then tentatively correlate their phasing.

Following the common practice within the Kınık Höyük project (e.g., d'Alfonso and Castellano 2018), periodization and phasing is based on three hierarchical categories: Period, Level, and Phase. A level is understood as indicative of a change in volume and/or function in a given space, and it is indicated by the trench code followed by a progressive number – e.g., C3W.1, refers to Level 1 in Trench C3W. A level can be divided into different phases, the latter considered to correspond to changes that do not produce significant modification of the volume and/or function of an area. Phases are indicated by lowercase letters, following the level code – e.g., C3W.1a, refers to Phase a of Level 1 in Trench C3W. Levels identified within the single sectors are attributed to Occupation Periods, which are based on comparative stratigraphy across the different operations and indicate general changes in the site layout and material culture. Occupation periods are indicated by roman numeral, following the site code: e.g., KH-P I, indicates the Occupation Period I (Seljuk/Early Ottoman). The general periodization of the site has been already introduced in Section 3.4.3, to which I refer the reader for further details.

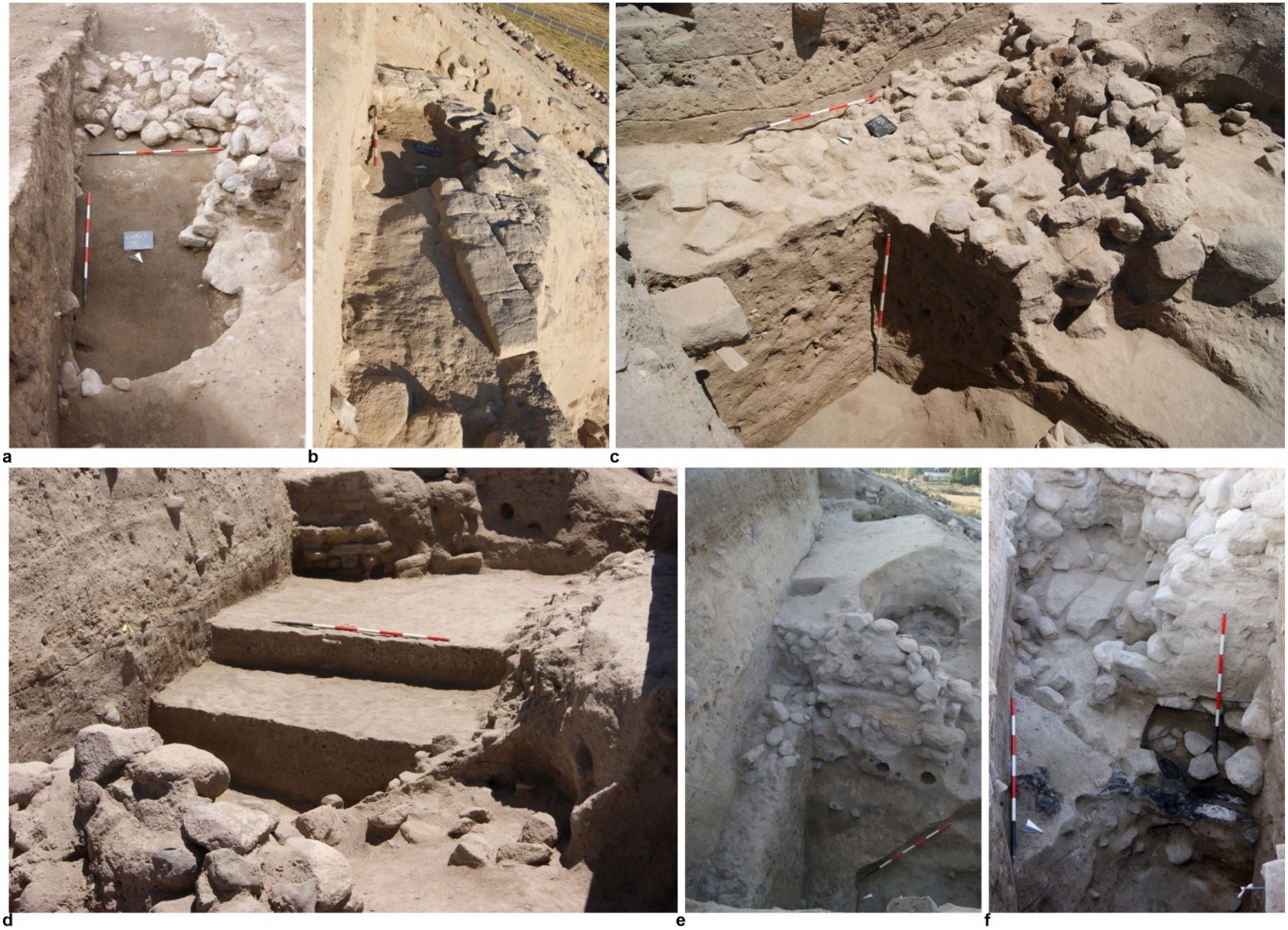
– C3E: the stratigraphic sequence to the inside of the citadel walls

Excavation conducted from 2015 to 2018 allowed to identify 5 levels in the deposit uphill (Trench C3E) the Iron Age citadel walls (Structure C659). The exposed occupation sequence spans from present to the Late Bronze Age (KH-P VI, 1600-1200 BCE); no materials or structures are, however, attributable to the Roman (KH-P IIA, 1-300 CE), Late Hellenistic (KH-P IIB, 200-1 BCE), and

Achaemenid/Early Hellenistic (KH-P III, 500-200 BCE) periods. As already mentioned, slope erosion is likely the cause of the absence of these occupation periods. Heavily impacted by erosion are also structures attributed to the Middle/Late Iron Age (KH-P IV, 800-500 BCE), which are preserved only in a narrow strip in the uphill portion of the trench.

Level C3E.0 – Modern occupation and activities. In addition to our excavation and the active slope processes, to this level is attributed a large pit (C2545). The fill of this pit contains abundant plastic and modern garbage, pointing to a very recent deposition. The dimension and the shape of the cut might suggest that it was conducted using a mechanic excavator – possibly either to extract building materials or for looting. The cut predates the beginning of the excavation project (2011).

Level C3E.1 – Medieval (?) negative structures (Figure 4.4, a). In addition to stratigraphically later unstructured pitting activities (Phase C3E.1a), this level is represented by negative structures cut into the citadel walls (C659) and the stratigraphic uphill of it (Phase C3E.1a1-3). Of particular interest is cut C2506, which defines an oval structure, which is partially 'vaulted' into the slope stratigraphy. The upper fills are characterized by well-sorted clay and sand layers (C2502 and C666), which are indicative of water-decantation sedimentation which followed the abandonment of the structure. The lower portion of the structure is filled by a sequence of soft sand layers (C2509, C2511) alternated to compact silt surfaces (C2504, C2510. C2512). This level is preliminary interpreted as part of a squatting occupation of this area of the mound, after that the walls felt out of use and that the slope was already in place. The presence within the structure of a single green glazed ceramic might tentatively point to a Medieval date (KH-P I; 1200-1450 CE).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(Previous page) Figure 4.4 – *Trench C3E, photos of main stratigraphic levels:* (*a*)*, Phase C3E.1b cut Structure C2506;* (*b*)*, Level C3E.2 mudbrick walls, cut by slope;* (*c*)*, fill of the Silo Structure C2522, the structure is attributed to Level C3E.3. To be noted that the structure has been partially excavated in 2015 and that it is in part cut by a Level C3E.1 negative structure;* (*d*)*, fill of the Silo Structure C2884, attributed to Level C3E.3;* (*e*)*, Silo C2522 after excavation;* (*f*)*, deep sounding underneath the silo C2522. To be noted the burnt layer* (*C2543*) *partially exposed and going underneath the inner façade of the citadel walls socle.*

Level C3E.2 – Late Iron Age architecture. In Trench C3E, the Middle/Late Iron Age occupation (KH-P IV, 800-500 BCE) is preserved exclusively in a narrow strip in the most northeastern (i.e., upslope) portion of the trench, being otherwise fully eroded by the active slope (Figure 4.4, b). Considered the limited exposure, it is impossible to reconstruct both architectural layout and functions. In order to properly investigate this occupation period, it would be necessary to expand the excavation area further to the northeast – i.e., uphill. In the current excavation limits, this level is characterized by a sequence of poorly preserved architecture (mud-brick walls), earthen surfaces, and pitting activities (Phases C3E.2a-d). To level C3E.2 are attributed also surfaces (Phases C3E.2e-f) found within one of the Level C3E.3 granaries (C2884), possibly indicating a squatting occupation of the structures following their abandonment. Lacking any stratigraphic relationship, due to erosion, we cannot verify whether the citadel walls were in function during Level C3E.2.

Level C3E.3 – Early/Middle Iron Age granaries. This level, attributed to KH-P VA (1000/800 BCE), has been exposed in the entire excavation area uphill of the citadel walls (C3E). Level C3E.3 is characterized by the presence of large-scale storage facilities (Figure 4.4, c-e), which are the main focus of this chapter (Section 4.2). Stratigraphic evidence, supported by the urbanistic layout of the area, indicate that during C3E.3 the citadel walls (C659) were in function. The masonry of the Iron Age citadel walls in Sector C3 is roughly 4 m thick, composed of unhewn stones, generally larger on the sides and smaller in the core, with voids filled by earth, stone chips, and mud mortar (Lanaro et al. 2018: 219).

Level C3E.4 – Early Iron Age layers. This level has been exposed exclusively in a deep sounding excavated in 2015 and 2018. The stratigraphic sounding was conducted starting from the bottom of Silo C2506 and of structure C2522; it cannot be excluded that other occupation levels/phases are present between C3E.3 and C3E.4, yet not preserved in the investigated area due to later cuts. At today, C3E.4a is the first phase detected prior to the construction of Level C3E.3 granaries, defined by the top-most ash accumulation (C2526) and an associated stone structure (C2535) abutted by those deposits. A second phase attributed to this level (C3E.4b) is a burnt surface C2543=C2892 and an associated stone structure (C2894) (Figure 4.4, f). Both those phases have radiocarbon dates centered in the mid-11th century BCE (Section 4.1.3), supporting an attribution to Period KH-P VB (1200-1000 BCE). Level C3.4 provides a post-quem term for the construction of the Iron Age citadel walls (Section 4.1.2).

Level C3E.5 – Late Bronze Age occupation. Two units (C2899 and C3401) found underneath phase C3E.4b mark a stratigraphic discontinuity in the sequence, defining a new level. To this level, exposed at the bottom of the 2015-2018 deep trench, are attribute the surface C3407 and the wall C3409. The investigated area is too limited to provide any meaningful interpretation. A Late Bronze Age (KH-P VI, 1600-1200 BCE) date of this occupation is supported by a radiocarbon determination (2σ calibration 1294.5 ± 76.5; Table 4.1) from a unit (C3411) directly covered by surface C3407.

– *C3W: the stratigraphic sequence on the outside of the citadel walls*

Trench C3W is located downslope of the citadel walls. Investigations in this area of C3 started in 2017 (d'Alfonso et al. 2018: 577-579), in a strip (ca. 5x15 m) in proximity of the outer façade of the Iron

Age citadel walls C659. The 2017 campaign allowed to expose an earthen rampart (C2673), which is associated to the Iron Age walls and covered by a thick sequence of accumulations rich in mixed Iron Age materials. In 2019 we expanded the excavation area 10m further downhill, to the southwest of the 2017 trench. The main aims of this operation, to be achieved in the coming years, are (*i*) to investigate the stratigraphy of the slope, (*ii*) to understand the stratigraphic and urbanistic relationship between the lower town and the citadel, (*iii*) to expose in a larger extent the Iron Age rampart, (*iv*) and to investigate the structure underneath the rampart, thus predating the exposed phase of the citadel walls. The stratigraphic sequence, updated to the end of the 2021 campaign, is summarized below.

Level C3W.0 – Modern slope and reworked topsoil.

Level C3W.1 – Hellenistic structures. Late Hellenistic (KH-P IIB; 200-1 BCE) deposits are preserved only in the most southwestern (i.e., downslope) area of C3W, being otherwise fully eroded by post-Hellenistic runoff. Two phases are attributed to this level: (*i*) C3W.1a, which is composed by accumulations (C3419, C3421, C3420, C3429, C3430, C3431, C3434) deposited on top of the stone structure C3432; and (*ii*) C3W.1b, the stone structure C3432 (Figure 4.5, b). The stone structure C3432 might be considered as part of architectural works postdating the abandonment of the Iron Age walls, aimed at consolidating the slope and limiting the erosive processes. Accordingly, C3432 could be tentatively interpreted as a stone glacis, perhaps functioning together with a hypothetic retaining wall present more upslope and fully eroded by run-off. On the basis of the associated materials, this phase (C3W1.b) is dated to a later stage of the Late Hellenistic Period (KH-P II). The identification of a stone glacis points to an unexpected degree of monumentality of the southern slope of the citadel during the late 2nd/1st century BCE. A thick Hellenistic and possibly Achaemenid stratigraphy is expected to be present further downslope, underneath the colluvial deposits originated by slope erosion.

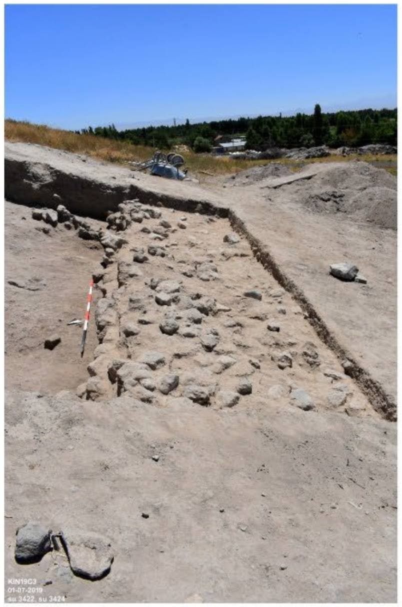
Level C3W.2 – Occupation surface. To this level are attributed a clay surface preparation (C3426) and a burn layer present underneath it (C3437). The stratigraphic position of this level is between the accumulations of top of the rampart (Level C3W.3) and the Late Hellenistic deposits (Level C3W.1). An absolute dating is, however, currently hampered by the lack of diagnostic in-situ materials. Pending either a larger exposure or radiocarbon determinations, we can only very generically attribute this level to a period between the Iron Age and the Late Hellenistic occupation.

Level C3W.3 – Iron Age accumulation. To this level is attributed a thick sequence of accumulations stratigraphically comprised between the Iron Age rampart surface C2673 and Level C3W.2 surface. This level can be divided into two phases: (*i*) C3W.3a, a thick sequence of highly accumulations deposited on top of a thick layer of pure clay (C3433); (*ii*) C3W.3b, a sequence of accumulations comprised between the rampart surface C2673 and the clay layer C3433. The latter unit, based on its selected composition and presence throughout the entire excavation area, it is preliminary interpreted as a layer purposely deposited in order to rise and level the slope surface as part of a general reorganization of the topography of the area. Preliminary screening of materials from Level C3W.3 suggests a coherent (although mixed) Iron Age assemblage, which is confirmed by radiocarbon dating (Section 4.1.2). The interpretation of these deposits is still open, possibly representing either slope accumulations deposited to the outside of the walls, colluvium in secondary deposition resulting from post citadel walls abandonment erosion, or a preparation of a hypothetic later rampart which surface has been fully eroded. The later hypothesis would find parallels in the sequence of rampart surfaces exposed in Operation A, on the opposite (northern) slope of the mound (Lanaro et al. 2020).

Level C3W.4 – Iron Age earthen rampart. This level, attributed to KH-P VA (1000-800 BCE) can be divided into three phases: (*i*) C3W.4a, rampart surface C2673 (Figure 4.5, c-d); (*ii*) C3W.4b, possible phase of dismissal of the citadel walls (cut C3469), to be confirmed in future excavation seasons; (*iii*) C3W.4c, surface C3466, possibly representing an earlier phase of the rampart. The latter two phases require to be further investigated in forthcoming excavation campaigns. On the other hand, the rampart surface of phase C3W.4a has been exposed in the entire excavation area. As noted in 2017, in the northern corner of the trench the rampart C2673 covers the lowest ~1.20 m of the citadel walls socle (C659). The rampart surface strongly slopes from east (~1210.20 m asl) to west (~1204.70 m asl), with a percent of slope of ~56%. Based on elevation of Iron Age strata in the Lower Town (Operation D2/3), and assuming a regular slope of the rampart, the latter would have a total length of ~23/24 m along its axis perpendicular to the citadel walls C659 – thus, continuing ca. 14/15 m beyond the current southeastern excavation limit, buried underneath a thick accumulation of colluvial deposits and later (Hellenistic and possibly Achaemenid) stratigraphy.

Level C3W.5 – To this level are preliminary attributed structures (C3470, C2862) stratigraphically earlier than surface C3466. These features have been exposed in limited sounding, both their chronology and function require further investigations.

(Next page) Figure 4.5 – *Trench C3W, photos of main stratigraphic levels:* (*a*), *Phase C3W.1a;* (*b*), *Phase C3W.b, Late Hellenistic stone glacis* (*C3432*)*;* (*c*) *and* (*d*)*, panoramic pictures of the citadel walls* (*C659*) *and of the associated earthen rampart*(*C2673*) *attributed to Level C3W.4, to be noted the presence of a sounding in proximity to the wall façade;* (*e*)*, stone structures exposed underneath the rampart surface C2673.*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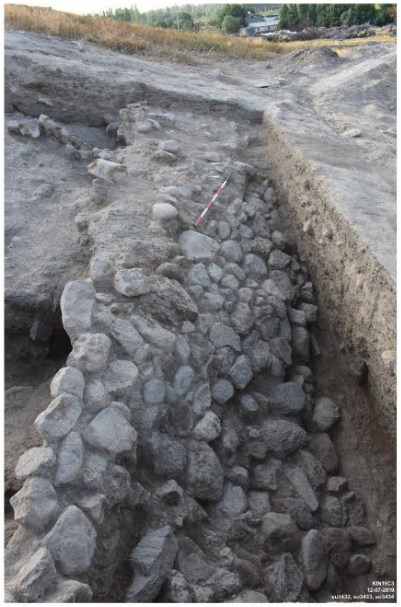
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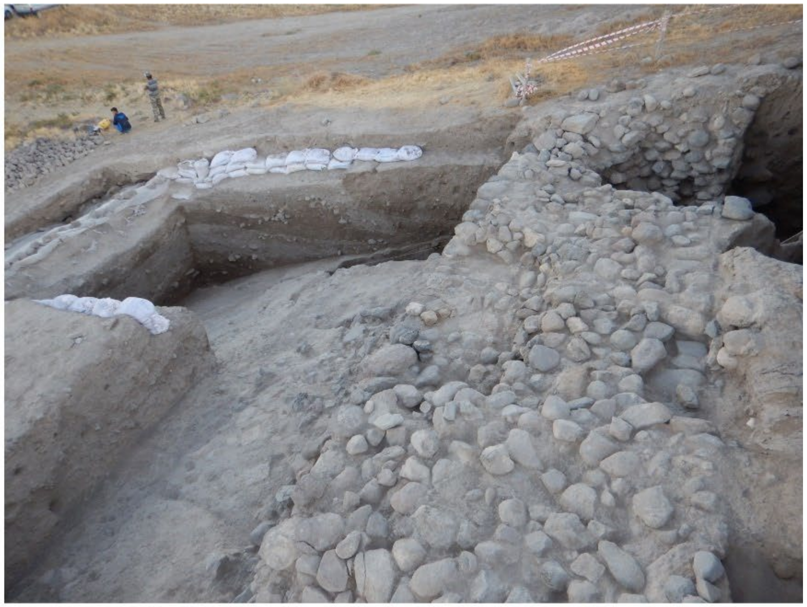

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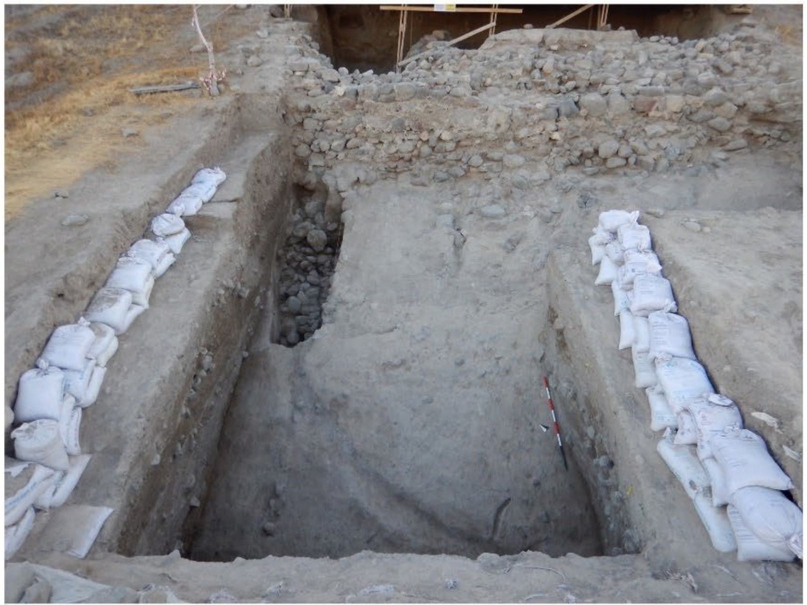

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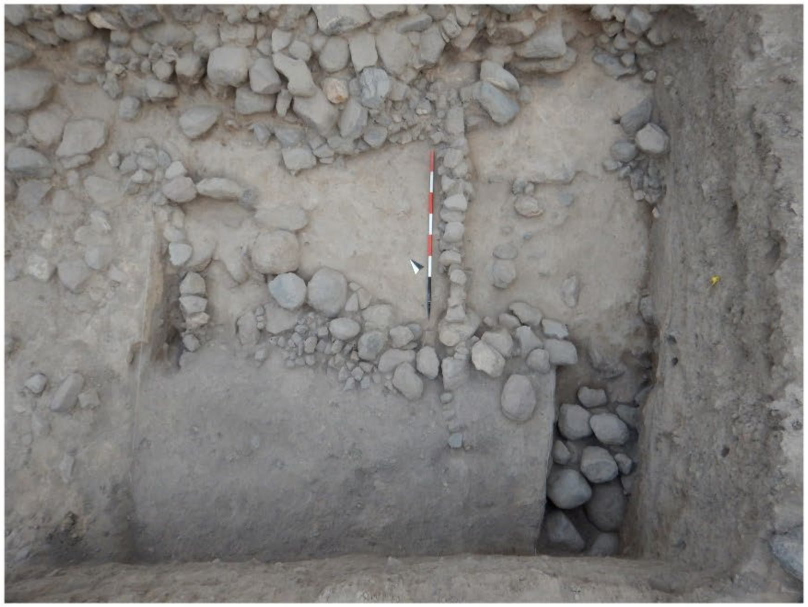

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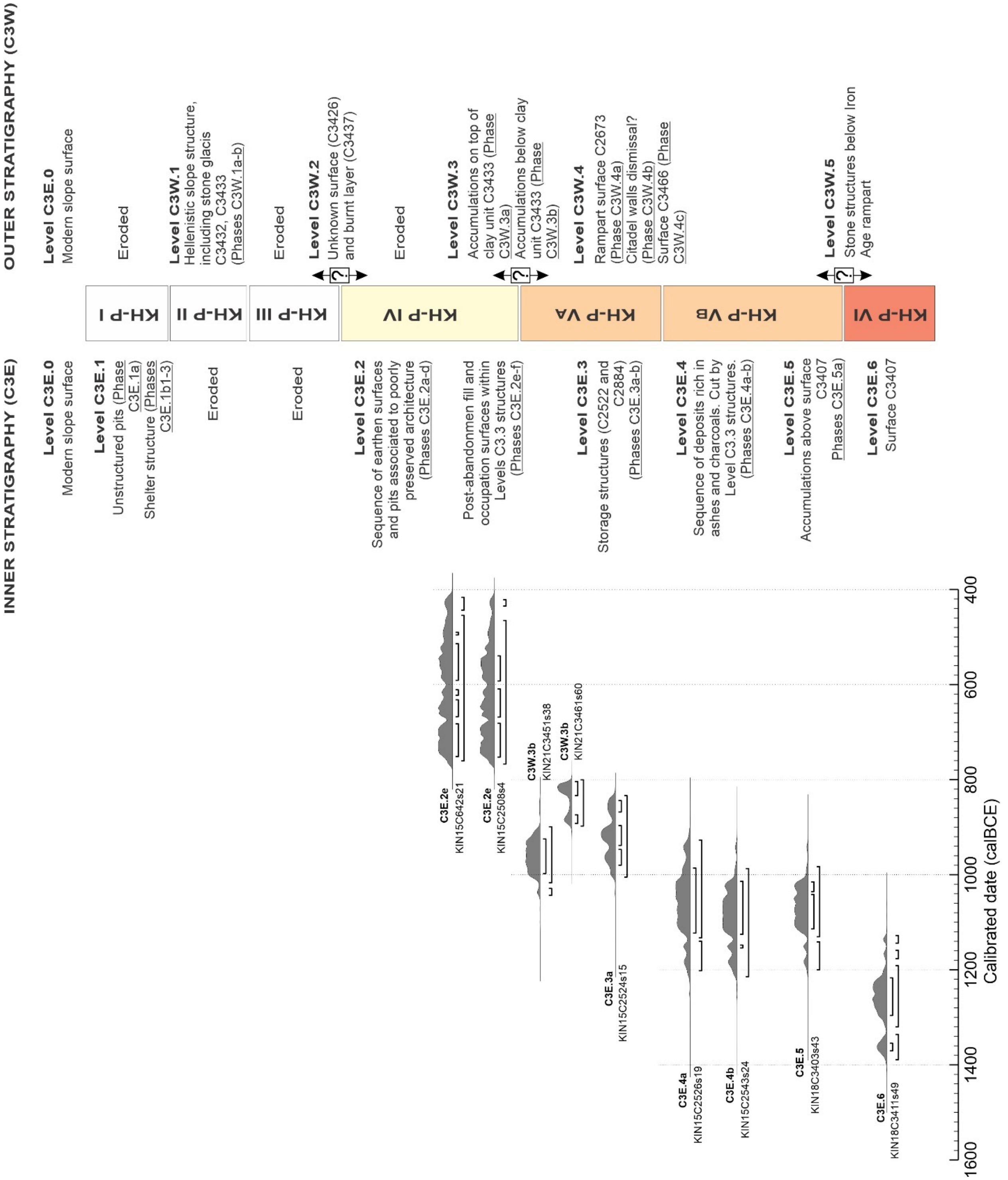
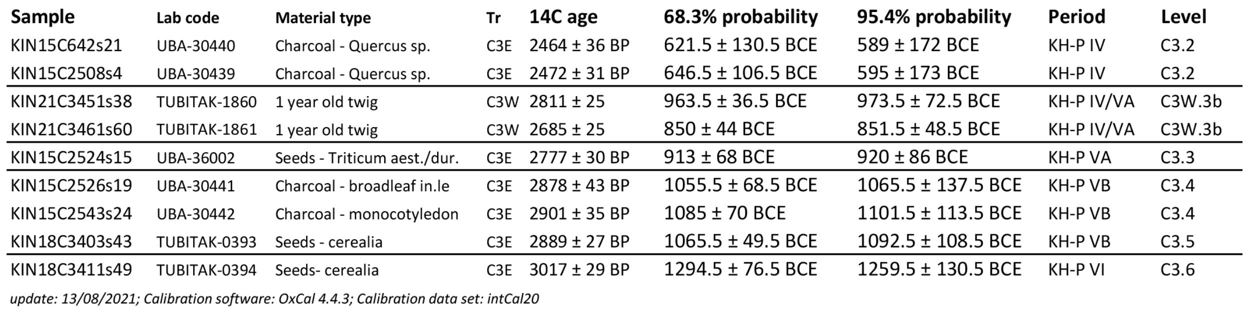


Figure 4.6 – *Sector C3, schematic phasing of Trench C3W and Trench C3E, with tentative correlation and attribution to N-KH periods. Calibration of the available radiocarbon dates from C3 are presented, for further details see* Section 4.1.2.

4.1.2 *Absolute dating*

In addition to typology, the absolute dating of the sequence exposed in Sector C3 (Figure 4.6) is based on a radiocarbon (AMS) determinations (Table 4.1).



Sample	Lab code	Material type	Tr	14C age	68.3% probability	95.4% probability	Period	Level
KIN15C642s21	UBA-30440	Charcoal - Quercus sp.	C3E	2464 ± 36 BP	621.5 ± 130.5 BCE	589 ± 172 BCE	KH-P IV	C3.2
KIN15C2508s4	UBA-30439	Charcoal - Quercus sp.	C3E	2472 ± 31 BP	646.5 ± 106.5 BCE	595 ± 173 BCE	KH-P IV	C3.2
KIN21C3451s38	TUBITAK-1860	1 year old twig	C3W	2811 ± 25	963.5 ± 36.5 BCE	973.5 ± 72.5 BCE	KH-P IV/VA	C3W.3b
KIN21C3461s60	TUBITAK-1861	1 year old twig	C3W	2685 ± 25	850 ± 44 BCE	851.5 ± 48.5 BCE	KH-P IV/VA	C3W.3b
KIN15C2524s15	UBA-36002	Seeds - Triticum aest./dur.	C3E	2777 ± 30 BP	913 ± 68 BCE	920 ± 86 BCE	KH-P VA	C3.3
KIN15C2526s19	UBA-30441	Charcoal - broadleaf in.le	C3E	2878 ± 43 BP	1055.5 ± 68.5 BCE	1065.5 ± 137.5 BCE	KH-P VB	C3.4
KIN15C2543s24	UBA-30442	Charcoal - monocotyledon	C3E	2901 ± 35 BP	1085 ± 70 BCE	1101.5 ± 113.5 BCE	KH-P VB	C3.4
KIN18C3403s43	TUBITAK-0393	Seeds - cerealia	C3E	2889 ± 27 BP	1065.5 ± 49.5 BCE	1092.5 ± 108.5 BCE	KH-P VB	C3.5
KIN18C3411s49	TUBITAK-0394	Seeds- cerealia	C3E	3017 ± 29 BP	1294.5 ± 76.5 BCE	1259.5 ± 130.5 BCE	KH-P VI	C3.6

update: 13/08/2021; Calibration software: OxCal 4.4.3; Calibration data set: intCal20

Table 4.1 – *Radiocarbon determination to date available from Sector C3. Calibrations were obtained in OxCal 4.4.3 (Bronk Ramsey 2017) using the IntCal20 calibration curve (Reimer et al. 2020).*

The dating of Level C3W.1 to the Late Hellenistic period (KH-P IIB) is based on finds, including two silver coins attributed to the reign of Ariarates V (163-131/130 BCE). The radiocarbon dates obtained from materials collected from Late Iron Age strata (Level C3E.2) fall, as expected, in the so-called Hallstatt Calibration Plateau (Table 4.1), which extends between ca. 800 and 400 cal. BCE (Jacobsson et al. 2018: 1). The dating of this level to KH-P IV (800-500 BCE) is based on ceramic typology, which finds comparanda in the richer assemblage from Sector A2, on the opposite side of the mound (Figure 4.1). The attribution of Level C3E.3 to period KH-P VA (1000-800 BCE) is based on stratigraphy and on radiocarbon dating of a use phase of the silo Structure C2522 (913 ± 68 cal. BCE, 2σ calibration; Table 4.1) as I will discuss further in Section 4.2.3. Based on urbanistic layout and stratigraphy, it is hypothesized that the citadel walls were in function during this phase, together with the earthen rampart present to their outside (Level C3E.4).

The construction of the Iron Age citadel walls has been dated to between 1085 ± 70 cal BCE (2σ calibration; C2543, burn layer stratigraphically earlier than walls) and 913 ± 67 cal BC (2σ calibration; C2524, use-phase of the Silo C2522) (Table 4.1). The dating of the abandonment of the Iron Age citadel walls cannot be dated in Sector C3, because of the lack of direct stratigraphic relationships between Level C3E.2 layers and the citadel walls C656, due to slope erosion. Based on parallels with Operation A (Lanaro et al. 2020), it could be speculatively hypothesized that the walls remained in function also during KH-P IV (800-500 BCE). Although exposed only to a very limited extent, the documentation – which is corroborated by radiocarbon dating (Table 4.1) – of Early Iron (KH-P VB, 1200-1000 BCE) and Late Bronze Ages (KH-P VI, 1600-1200 BCE) strata supports the presence of a continuous stratigraphic deposit in Trench C3E, from the Late Bronze to the Late Iron Ages.

4.2 Large-scale storage from Niğde-Kınık Höyük `Operation C

After a due introduction to the general stratigraphic sequence exposed in C3, in the following section I will concentrate on the storage infrastructure attributed to level C3E.3, corresponding in the site periodization to KH-P VA (1000-800 BCE).

4.2.1 *The archaeological evidence: Silo 1 (C2522)*

Silo C2522 is located in the northern corner of Trench C3E, continuing beyond the northwestern and northeastern excavation limits (Figure 4.7). On the basis of the exposed portion of the structure, we can reconstruct a circular or slightly elliptical plan of more than 8 m in diameter and a maximum preserved depth of about 3 m. Its upper part is composed of unworked stones (20 to 40 cm), lined by chaff plaster preserved as patches of orange friable debris with monocotyledon stems still visible

(Figure 4.7); this part of the structure (stone installation C2839) is shared with a second silo-pit (C2884) (Section 4.2.2). The lower part of Silo C2522 is cut into the stratigraphy below, with earthen walls covered by a thick (maximum 5 cm) layer of chaff plaster, showing characteristics closely comparable to those described above (Figure 4.8). On the bottom we recognize two distinct levels of straw coating (units C2521 and C2525), likely representing two distinct phases of use of the structure separated by a 5 to 10 cm thick gray accumulation (unit C2524) (Figure 4.8, b-c).

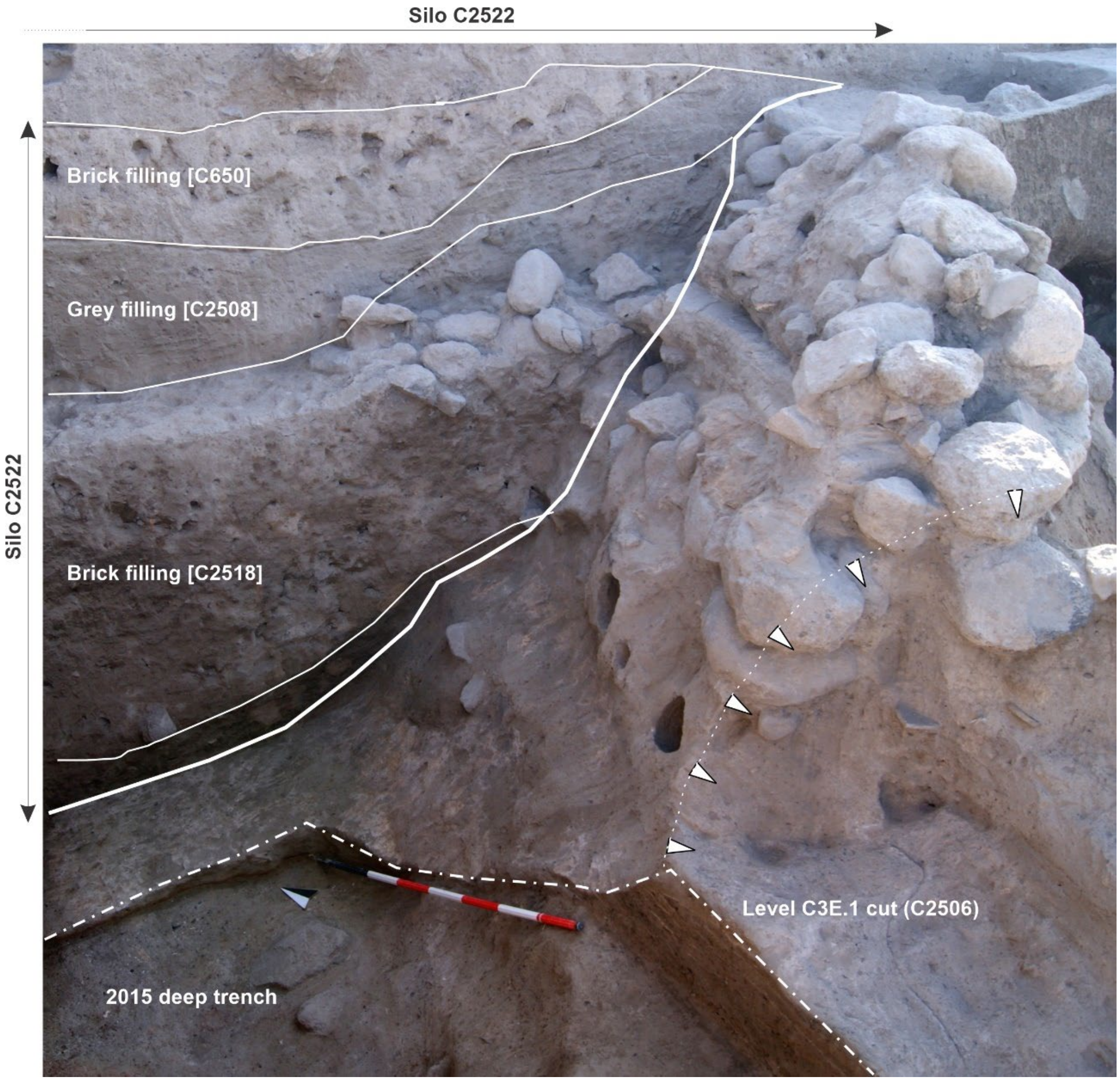

Silo C2522
Silo C2522
Brick filling [C650]
Grey filling [C2508]
Brick filling [C2518]
Level C3E.1 cut (C2506)
2015 deep trench

Figure 4.7 – *Annotated pictures of Silo C2522 from Operation C-Sector C3: view from southwest to northeast, showing in section the post-dismiss fillings of Silo C2522. The indicated cut is part of a much later structure (Level C3E.1, Medieval).*

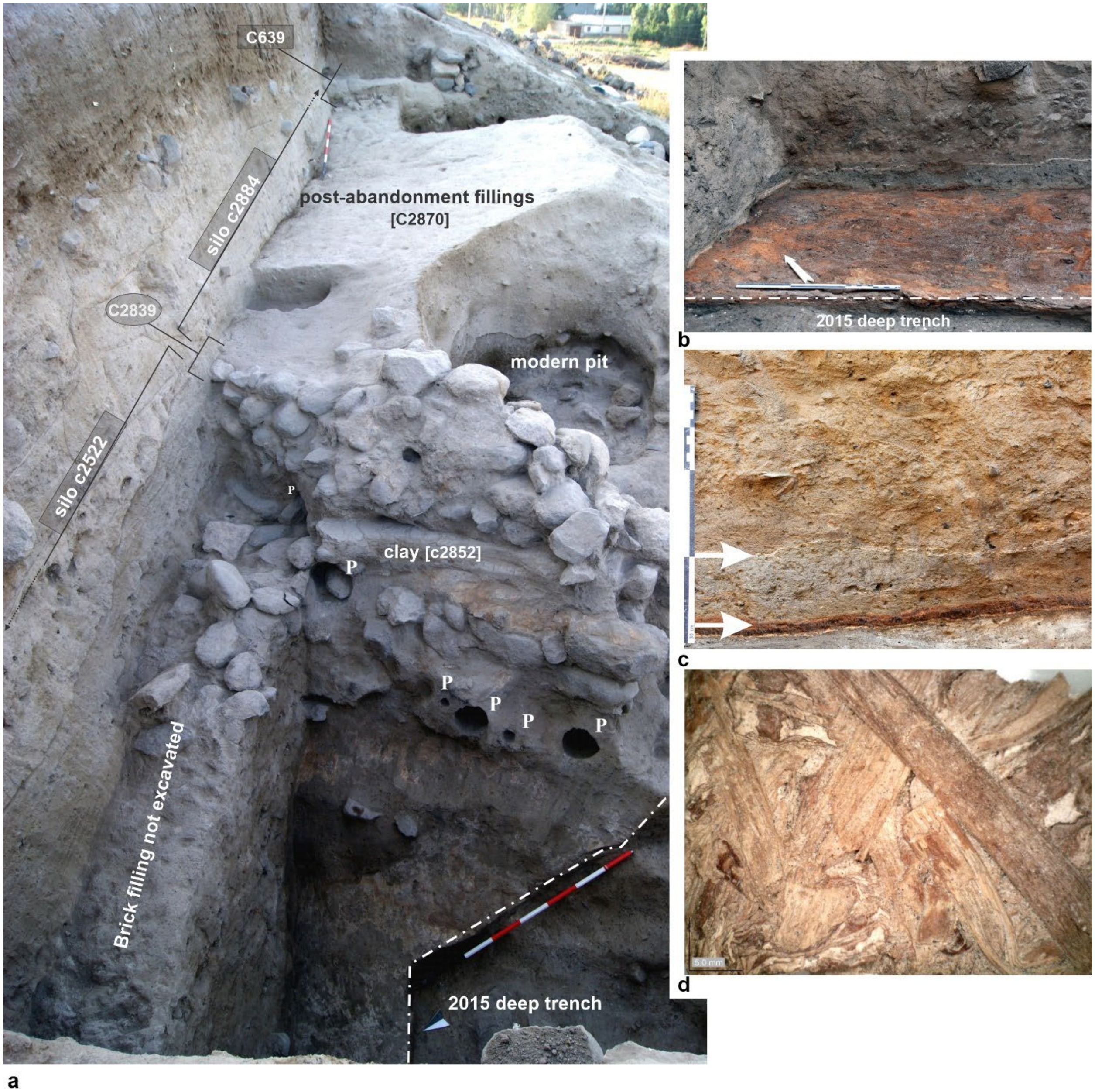

C639
silo c2884
post-abandonment fillings
[C2870]
C2839
modern pit
silo c2522
P
clay [c2852]
P
P
P
P
P
Brick filling not excavated
2015 deep trench
a
2015 deep trench
b
c
5.0 mm
d

Figure 4.8 – *Annotated pictures of Silo C2522 from Operation C-Sector C3: (a), view from northwest to southeast; Silo C2522 is fully exposed; "P" indicates the postholes, "clay" the clay layer abutted by the mud-bricks filling the structure; the "modern pit" is attributed to Level C3E.0, possibly a looting pit. Note the remains of chaff plaster (orange debris on the bottom of the structure and lining on its walls). The photograph of Silo C2884 was taken before the excavation of its post-abandonment fillings; (b), bottom of the silo with preserved vegetal plaster (C2525); (c), detail of the section, the arrows indicate the two levels of vegetal plastering (C2521 and C2525) separated by a grey accumulation (C2524); (d), detail of the vegetal plaster showing intertwined monocot stems.*

On the exposed side, it is possible to notice circular, horizontal postholes – perhaps dug to accommodate wooden pegs (Figure 4.8, a). A layer of pure, well-sorted clay (C2852) covered by the post-abandonment filling is preserved on the wall of the silo, mid-height of the stone superstructure and abutting it – possibly indicating either an alluvial episode or what remains of the earth plug functional to ensure anoxic conditions during storage (Figure 4.8, a). After the silo fell out of use, it was cleaned and filled with two very thick layers of mudbrick debris (C650 and C2518) separated by a grey sandy unit (C2508) (Figure 4.9). Those units were likely deposited in order to fill the silo and level the area prior to the construction of new structures during the following occupational level (C3E.2).

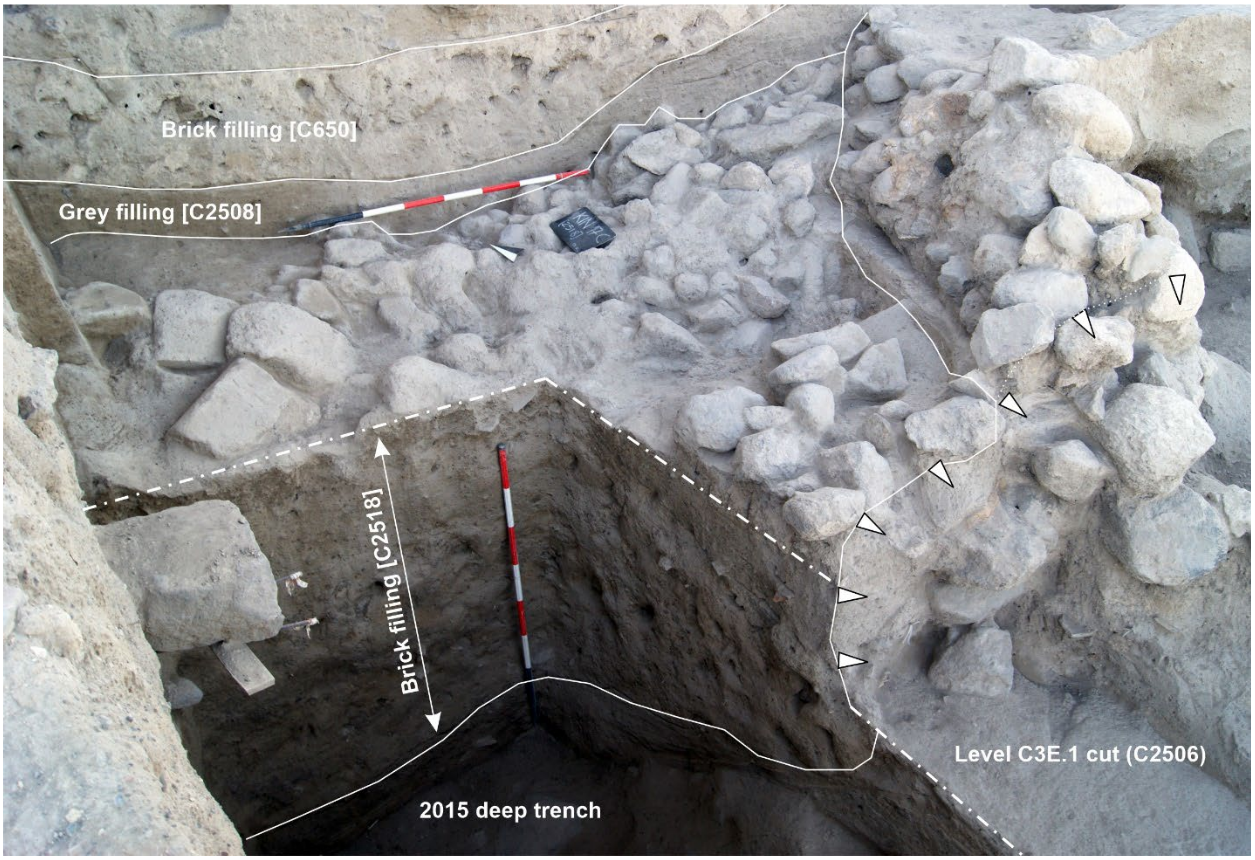


Figure 4.9 – *Annotated pictures of Silo C2522 from Operation C-Sector C3. This photo was taken before the excavation of the brick felling C2518 during the 2017 excavation season. C2518 is a ~2 m thick unit composed by mudbrick and stone. A second layer un mudbrick (C650) seals the storage structure. Within the limits of the 2015 deep trench the unit was already excavated. To be noted the presence of a later (Level C3E.1) cut.*

4.2.2 *The archaeological evidence: Silo 2 (C2884)*

During the 2018 excavation campaign a second silo (structure C2884) was brought to light (Figure 4.10, 4.11, 4.12). As already mentioned, this silo is joined to the one previously described through the stone installation C2839, which defines the respective northwestern and southeastern limits of the two storage structures (Figure 4.10). The façade of the stone installation associated with Silo C2884 is preserved for four exposed rows of stones, lined by small and discontinuous patches of chaff plaster. The southwestern limit of the structure, heavily eroded by the mound slope, is cut into a narrow strip of deposits, separating the silo from the citadel walls.

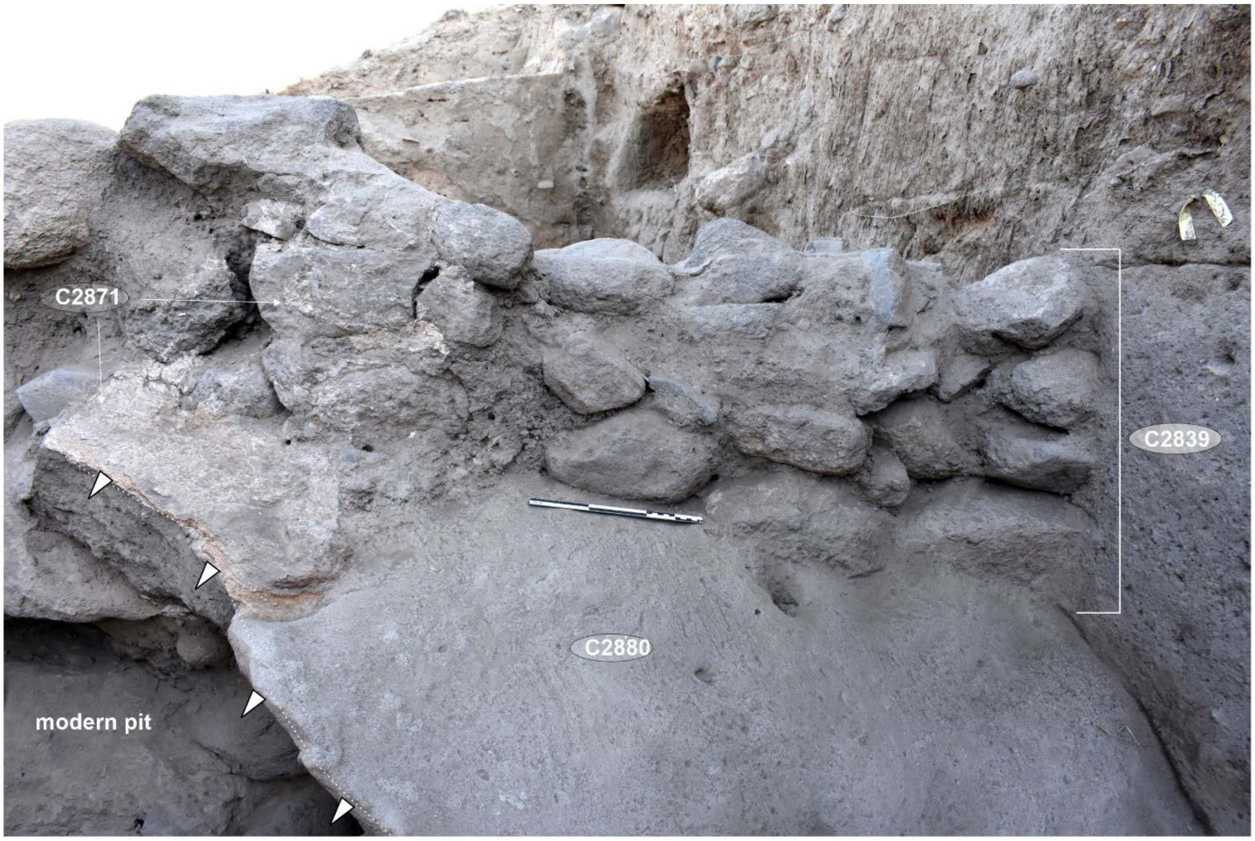


Figure 4.10 – *Annotated picture of Silo C2884: detail of the stone installation C2839, which divides Silo C2522 from Silo C2884. Note the patches of chaff plaster (C2871) on top of the sand surface (C2880) and lying on the stone installation.*

Among the other structural features which comprise Silo C2884, we should mention the mud-brick wall C639, located along the southeastern excavation limit (Figure 4.11, b and 4.12). We preliminarily interpret this wall, preserved for a height of about 2.40 m, as an internal partition of the silo into two chambers, of which only the northwestern one lies within the current excavation limits. If this interpretation is correct, by doubling the currently exposed length of the silo (ca. 7.5 m) we should have an approximate measure of the main axis of the structure.

The maximum preserved depth of the silo measures about 2.40 m, found at the northeastern excavation limit and halfway between the mud-brick wall, C639, and the stone installation, C2839. However, the presence of a steep northeastward slope near the excavation limit suggests that the center of the structure lies beyond this position. Therefore, the extent of the short axis of the structure must exceed the double of its exposed width (ca. 3.5 m).

Chaff plaster, in all respects the same as the one previously described from Silo C2522, is found only in small patches: on a corner of the structure in the proximity of its northwestern limit (unit C2871) (Figure 4.10) and on its bottom (unit C2883) (Figure 4.12, a). Otherwise, the preserved silo surface is composed of the layer of pressed sand below (unit C2880) (Figure 4.11), interpreted as the preparation on top of which the plaster was originally applied. The remarkably optimal preservation condition of the chaff plaster of Silo C2522 is possibly connected to its burial shortly after the abandonment of the structure under a thick layer of mud-brick debris – preventing erosion of the plaster from atmospheric phenomena or its removal by humans, while at the same time creating the anoxic conditions favorable to organic matter preservation.

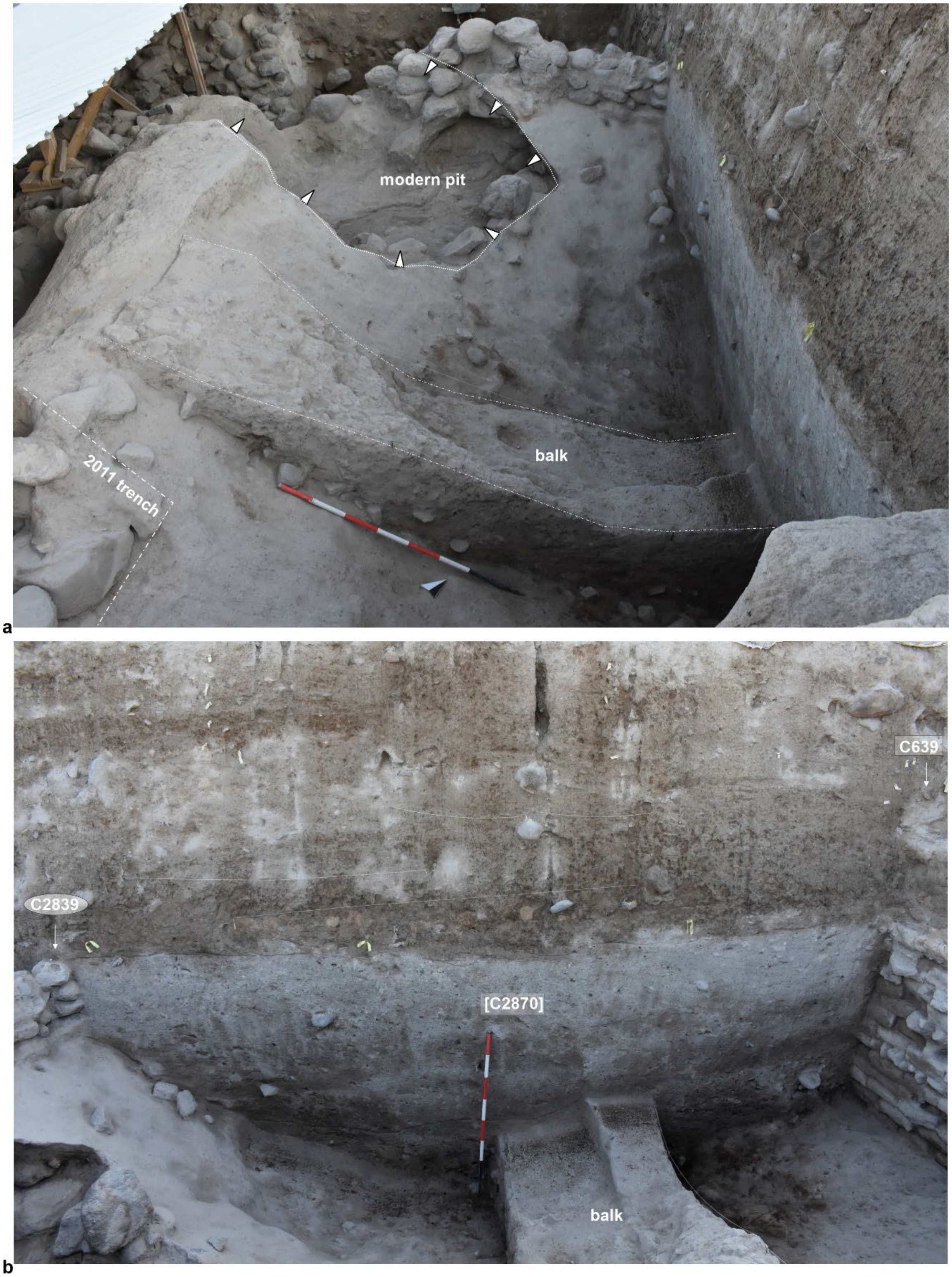

modern pit
balk
2011 trench
a
C639
C2839
[C2870]
balk
b

Figure 4.11 – *Annotated pictures of Silo C2884: (a), view from southeast to northeast. In the background the stone installation C2839, dividing Silos C2522 and C2884; (b), view from southwest to northeast. Note on the right the wall C639 and to the left stone installation C2839. The grey unit filling the structure is C2870.*

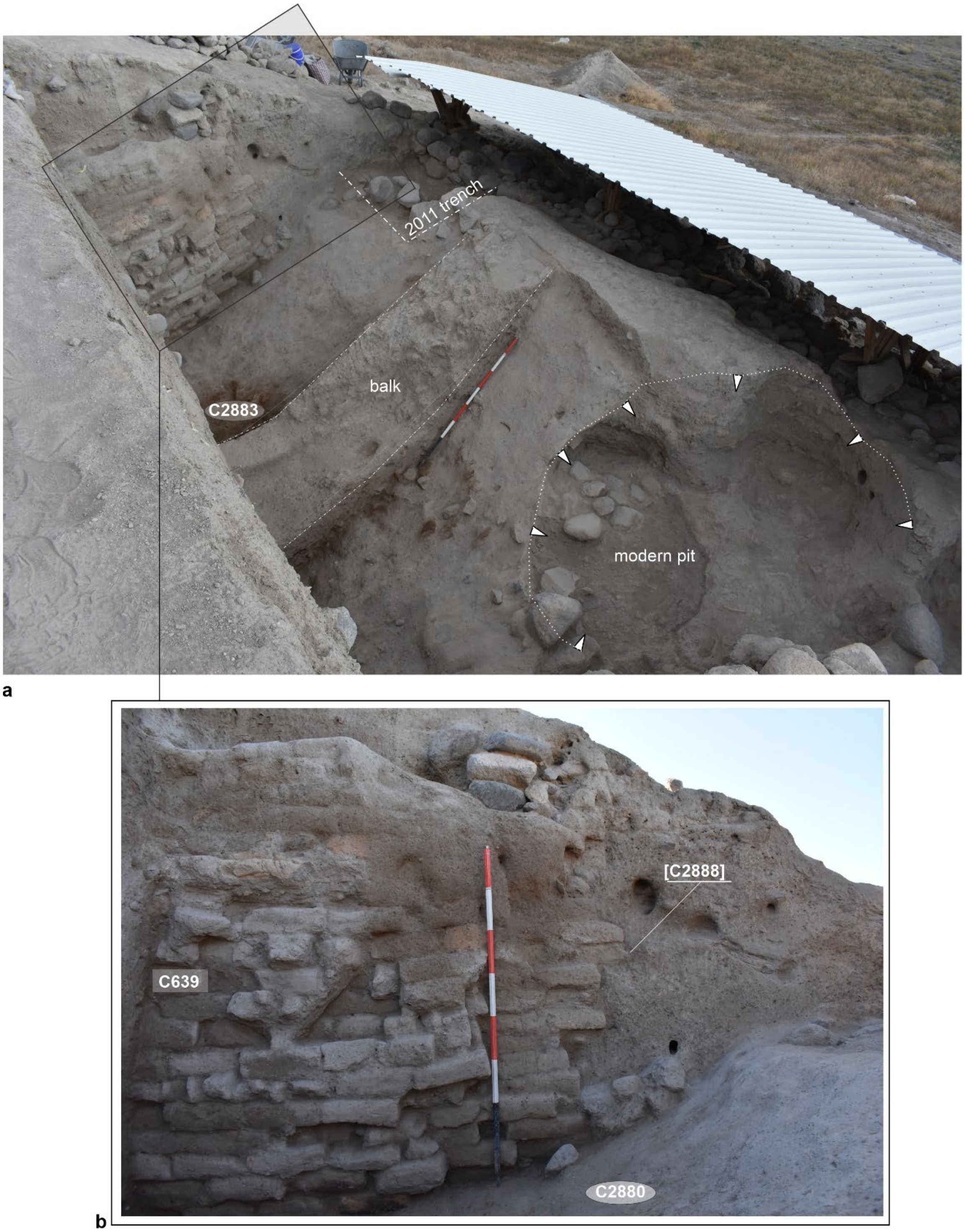

2011 trench
balk
C2883
modern pit
a
[C2888]
C639
C2880
b

Figure 4.12 – *Annotated pictures of Silo C2884 from Operation C-Sector C3:* (*a*), *view from north to south. Note the orange patches of chaff plaster* (*C2883*) *and on the background the wall C639, interpreted as dividing the silo into two chambers. The balk in the center of the structure is left unexcavated for conservation purposes, providing support for the bases of the removable roofs installed at the end of the season;* (*b*), *detail of the wall C639. Note the presence of a later cut* (*C2888*).

The significantly poorer condition of the plaster in Silo C2884 suggests a different post-abandonment history: this second storage structure appears to have been filled more slowly and partially subjected to spoil, as indicated by the presence in the lowest post-abandonment unit (C2879) of copious construction materials (mudbricks, pebbles, large patches of vegetal plaster). The silo was otherwise filled mostly by a very thick deposit of grey sand-silt (unit C2870) (Figure 4.11, b), characterized by small patches of chaff plaster in a clearly secondary context. The uppermost portion of this unit, near the southeastern trench limit, is interdigitated with some possible occupation surfaces, signaled by the presence of in-situ burning and abundant ceramics. Hence, after the structure was abandoned and partially filled (and continued to be filled), some occupational activities occurred; perhaps the space was put to use as part of an external area. This sequence is stratigraphically closed by the uppermost mud-brick debris filling of Silo C2522 (unit C650), which also extends partially on top of Silo C2884, representing the last post-abandonment filling of the two silos on which the following occupation phase was set (Level C3.2). Because of later cuts (modern, Level C3.0; medieval, Level C3.1) and slope erosion, the direct stratigraphic relationship between the two silos and the masonry of the citadel walls is not observable. However, the fact that the infrastructure clearly respects the defensive wall suggests that the latter was in function during this phase. Further confirmation comes from the general chronology of the citadel walls, as documented in other excavation areas (Highcock et al. 2015: 102–6).

4.2.3 *Radiocarbon chronology*

On a stratigraphic basis the aforementioned storage structures are attributed to Level C3E.3, part of the Early-Middle Iron Age occupation of the site (Period KH-P VA, from 1000 to 800 BCE)

(Section 4.1). In addition to the ceramic and stratigraphic evidence, the absolute dating of those structures is supported by a sequence of radiocarbon AMS determinations conducted at the Chrono Center of Queen's University (Belfast) on materials sampled from Silo C2522 (Table 4.1).

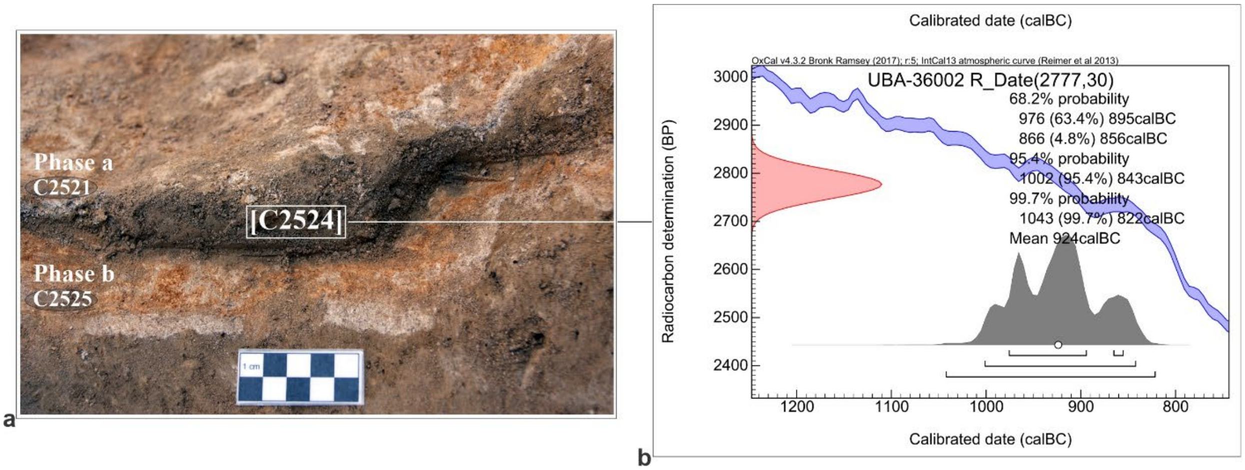


Figure 4.13 – *Operation C-Sector C3, radiocarbon dating of Silo C2522:* (*a*)*, detail of the bottom of the Silo C2522, showing the two phases of chaff plastering, and the centimetric sediment layer in between* (*unit C2524*)*;* (*b*)*, calibration plot of the radiocarbon date obtained from the* Triticum durum/aestivum *caryopses sampled from SU C2524* (*for further details see Table 4.1*).

The two uppermost samples in the stratigraphy postdate the abandonment of the structure C2522; those samples come from an ashy layer above the silo (UBA-30440, unit C642) and a post-abandonment filling of the structure (UBA-30439, unit C2508). Both dates fall in the so-called "Hallstatt plateau", a well-known flat section in the radiocarbon calibration curve between ca. 800 and 400 cal. BCE (Jacobsson et al. 2018: 1). In order to date the construction and subsequent use of the silo, we purposely avoided submitting uncharred remains of the chaff plaster (as done, for example, for the silos of Boğazköy; Schoop and Seeher 2006: 57–58 and 60–61), since in our case this material is rich in modern hyphae, potentially affecting the radiocarbon determination. Instead, we decided to process a 2 to 5 cm grey silty-sandy deposit (unit C2524) fully sealed between the two phases of chaff plastering of the structure (Figure 4.13, a): postdating the earlier plastering of the structure and predating the latter.

We submitted short-life materials (caryopses of naked wheat – *Triticum aestivum/durum*) found in this unit for radiocarbon determination (UBA-36002), which returned a calibrated date centered in the 10th century BCE – 1σ (63.4% probability) 976–895 cal. BCE; 2σ (95.4% probability) 1002–843 cal. BCE (Figure 4.13, b). The lowest chronological limit, predating the construction of the silo, comes from a radiocarbon date of one of the uppermost units cut by the storage structure (UBA-30441, unit C2626), which gave a calibrated age centered in the 11th century BCE – 1σ (68.2% probability) 1123–996 cal BCE; 2σ (95.4% probability) 1134–928 cal. BCE (Table 4.1).

4.2.4 *Grain storage at Niğde-Kınık Höyük during period KH-P VA*

The evidence presented in the previous sections indicates the presence of large-scale storage structures dating to the Early-Middle Iron Age in the southern sector of the citadel of Niğde-Kınık Höyük (Figure 4.14). Based on the stratigraphic sequence and a solid radiocarbon chronology, we can reconstruct that Silo C2522 was built around/shortly after the 11th century BCE, was in use during the 10th century BCE, and then dismantled and filled during a later phase of the Iron Age.

Because of the presence of a significant plateau in the calibrations, radiocarbon can provide only a broad chronological range for the abandonment of the silo. It appears that an ante quem dating for the disuse of the structure to the 8th to 7th century BCE is likely, as further confirmed by the stratigraphic sequence sealing the structure, rich in Late Iron Age I materials. As of now, there are no radiocarbon dates available for the second excavated silo (C2884), unearthed during the 2018 campaign. However, on a stratigraphic basis the two structures are clearly part of the same occupation level (Level C3E.3), and it is safe to assume that the two silos are coeval and built as part of a coherent project aimed at creating storage facilities in this specific area of the citadel. The reconstructed dimensions of those structures unequivocally indicate facilities purposely built for the storage of a large quantity of crops far exceeding domestic demands. It is noteworthy that these silos are housed in a well-planned urban context within the citadel and in proximity to the defensive walls (Figure 4.14). In addition to their dimensions, location, and urban context, we should also observe the technical details of their construction, clearly indicating the type of carefully designed infrastructure crucial for the long-term storage of large quantities of staple products.

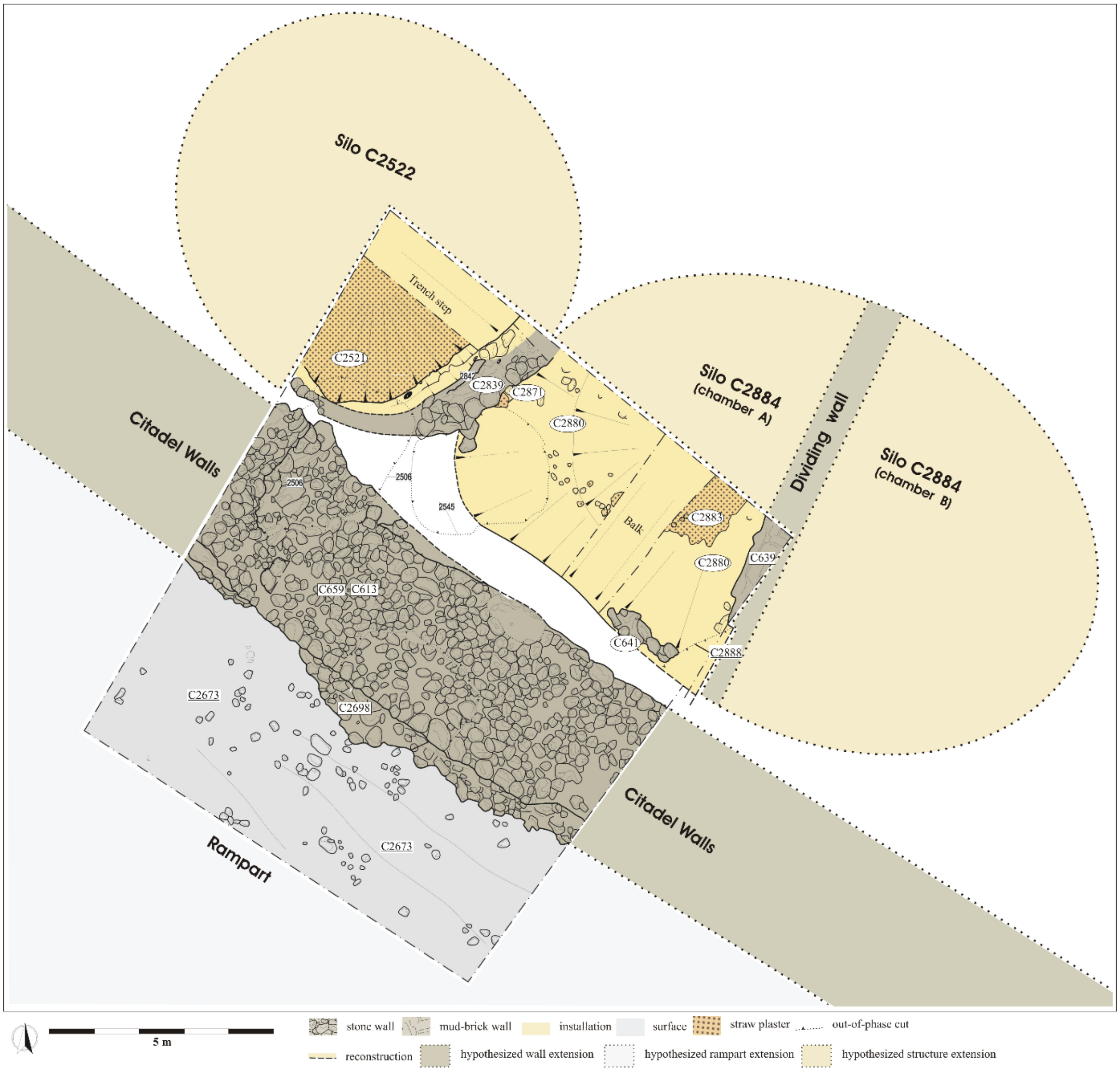

Silo C2522
Trench step
C2521
2847
C2839
C2871
C2880
Silo C2884 (chamber A)
Dividing wall
Silo C2884 (chamber B)
Citadel Walls
2506
2506
2545
Balk
C2883
C2880
C639
C659
C613
C641
C2888
C2673
C2698
C2673
Citadel Walls
Rampart
5 m
stone wall
mud-brick wall
installation
surface
straw plaster
out-of-phase cut
reconstruction
hypothesized wall extension
hypothesized rampart extension
hypothesized structure extension

Figure 4.14 – *Simplified plan of the silos from Operation C-Sector C3 and associated features (Level C3E.3) with reconstructed extension of the structures.*

The goal of crop storage is to preserve the stored goods in prime condition for as long as possible. In the case of cereals, it is necessary to maintain the caryopses ungerminated, allowing for later human consumption, and at the same time to preserve the ability of the grains to germinate when needed, allowing for use in sowing or malting. Those goals are achieved by controlling moisture, oxygen, and temperature: all factors managed through several technical stratagems employed by underground silos (for a general overview see Seeher 2006). Conversely, moist and warm environments cause germination, fungal propagation, and insect infestations (Food and Agriculture Organization of the United Nations 2011: 375–83) (Figure 4.15).

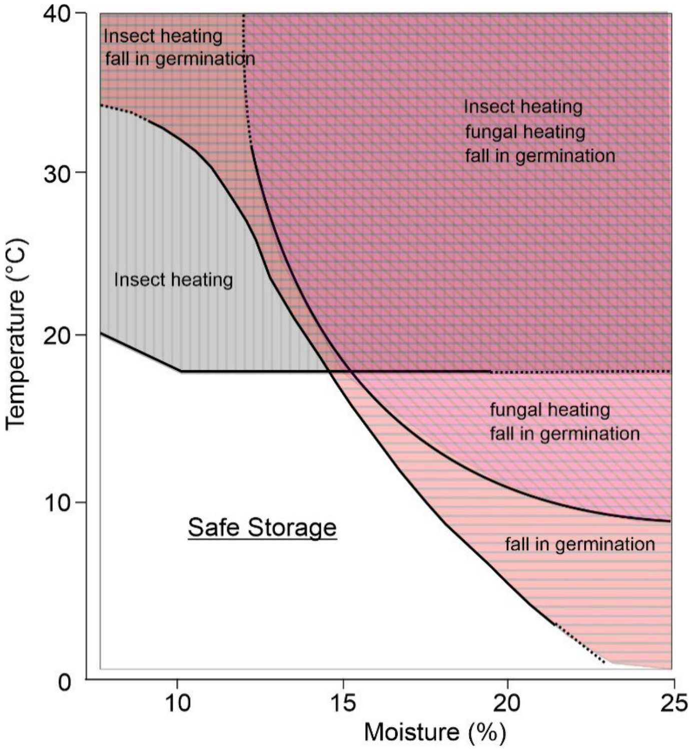


Figure 4.15 – *Schematic representation of storage conditions in relation to moisture and temperature in the storage environment. (Redrawn from Food and Agriculture Organization of the United Nations 2011).*

Underground granaries are generally dug in well-drained areas, the citadel mound in the case of Kınık Höyük – a solution which also ensures control and protection of the stored goods. In order to limit humidity emanating from the surrounding soil, the inner surfaces are often plastered, in our case with a straw coating (Figure 4.8). As already discussed by Seeher (2000: 273–75), ethnographic observations stress the importance of cleaning between different episodes of storage. Once emptied, one of the most effective ways to sanitize the structure is to cover the old surfaces of the silo with a layer of earth and apply over it a new layer of plaster. Therefore, the presence of different coats of plaster suggests different phases of use. Finally, in order to create the necessary anoxic conditions, once filled with cereals, the structure is plugged by a layer of earth or mud (Figure 4.16), as possibly indicated in the case of Silo C2522 by the remains of pure clay abutting the upper border of the structure and abutted by the post-closure fillings (Figure 4.8, a).

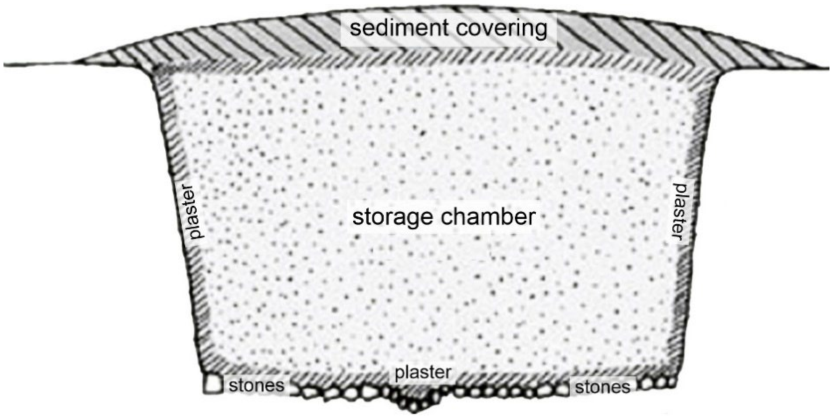


Figure 4.16 – *Schematic representation (section) of an underground storage silo, based on archaeological evidence from Büyükkaya, at Boğazköy-Ḫattuša. (After* Mielke 2011*).*

Large-scale structures, such as the ones from Kınık Höyük Operation C, are exclusively designed for long-term storage, as they are technically unsuitable for intermittent or frequent opening. In fact, by removing the earth layer sealing the structure, the anoxic conditions on which the preservation of the storage depends are irreversibly disrupted, compromising the viability of the stored products. The day-to-day and month-to-month demands for grain are, therefore, fulfilled by means of other forms of storage, such as smaller silos and bag/vessel storage. In short, different storage techniques are clearly not mutually exclusive but fulfill different needs present in the specific socio-cultural context.

4.3 The evidence of Niğde-Kınık Höyük in the Anatolian context

4.3.1 *Late Bronze Age centralized storage*

The evidence from Niğde-Kınık Höyük indicates the presence of large-scale storage facilities dating to the 10th century BCE. In the Anatolian context, this type of structure – its scale, location, and technical features – directly recalls earlier Late Bronze Age examples (Figure 4.17). The recognition of the crucial role of massive storage of staple products in Late Bronze Age Central Anatolia is a recent achievement in Hittitology and Anatolian archaeology, mostly connected to new discoveries at Boğazköy-Ḫattuša since the late 1990s.

In the outcrop of Büyükkaya, a German team excavated eleven rectangular/squared silo-pits, with dimensions varying from 12x18 m to 6x6 m and exceeding 2 m in depth (Seeher 2000: 270-78). The bottoms of these silos are generally paved with stones and include a central hole for drainage (Figure 4.18, a); moisture was also contained by the application of chaff plaster on the inner surfaces. Radiocarbon dating of the vegetal plaster of Silo 8 (17th to beginning of the 16th century BCE) and Silo 4 (13th century BCE) indicates that the hill of Büyükkaya hosted storage facilities throughout the entire Late Bronze Age (Schoop and Seeher 2006: 57–58). A very similar structure, radiocarbon-dated to the 16th century BCE, was also discovered in the Upper City, cut by the construction trenches of one of the ponds of the Südteiche complex (Schoop and Seeher 2006: 60-61). The so-called Silo-complex, unearthed in the Lower City in proximity of the Postern Wall, is impressive for its capacity and overall scale: an underground building comprising 32 large rectangular chambers used for cereals storage (Seeher 2006) (Figure 4.18, c). This structure was partially destroyed by a fire, preserving large quantities of in situ cereals sealed by the original earth plug (Diffey et al. 2020). Nine radiocarbon determinations provide a combined calibrated date with probability peaks in the first quarter and middle of the 16th century BCE (Seeher 2006: 74–78; Schoop and Seeher 2006: 59–60).

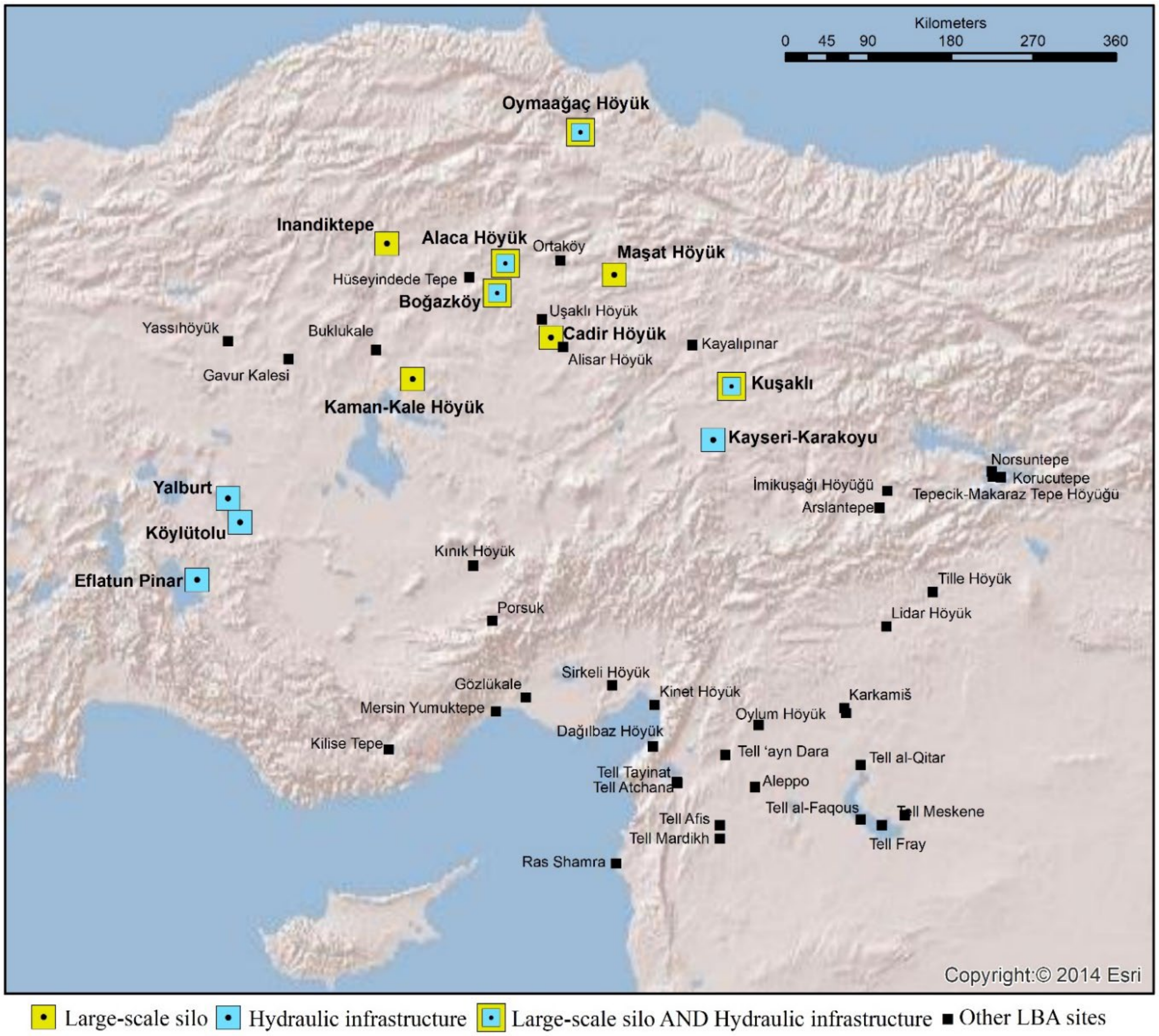

Kilometers
0 45 90 180 270 360
Oymaağaç Höyük
Inandiktepe
Alaca Höyük
Ortaköy
Maşat Höyük
Hüseyindede Tepe
Boğazköy
Uşaklı Höyük
Cadir Höyük
Alisar Höyük
Kayalıpınar
Yassıhöyük
Buklukale
Gavur Kalesi
Kaman-Kale Höyük
Kuşaklı
Kayseri-Karakoyu
Norsuntepe
Korucutepe
Tepecik-Makaraz Tepe Höyüğü
İmikuşağı Höyüğü
Arslantepe
Yalburt
Köylütolu
Eflatun Pinar
Kınık Höyük
Tille Höyük
Porsuk
Lidar Höyük
Sirkeli Höyük
Gözlükale
Kinet Höyük
Karkamiš
Mersin Yumuktepe
Oylum Höyük
Dağılbaz Höyük
Kilise Tepe
Tell 'ayn Dara
Tell al-Qitar
Tell Tayinat
Tell Atchana
Aleppo
Tell al-Faqous
Tell Meskene
Tell Afis
Tell Mardikh
Tell Fray
Ras Shamra
Copyright:© 2014 Esri
Large-scale silo
Hydraulic infrastructure
Large-scale silo AND Hydraulic infrastructure
Other LBA sites

Figure 4.17 – *Late Bronze Age large-scale storage facilities and hydraulic infrastructures. Additional important Late Bronze Age sites are marked.*

Following the discoveries from Boğazköy, either as the result of new excavations or reinterpretations of older data, several other Late Bronze Age large-scale storage infrastructures were identified in Central Anatolia (Figure 4.17). Three trapezoidal silo-pits, resembling the structures from Büyükkaya, were found at Alacahöyük (Çınaroğlu and Çelik 2010: 311–19), attributed to the 2nd Structure-

2nd Culture Level (Çınaroğlu and Çelik 2010: 276-277). Another squared large-scale silo-pit dated to the Middle/Late Bronze Age transition (Czichon et al. 2016: 14) was recently found at Oymaağaç-Nerik (Czichon et al. 2016: 38–41). Structures in all respects similar, but with a circular rather than squared plan, are known from Kaman-Kalehöyük Level IIIb (Fairbairn and Omura 2005) (Figure 4.18, b) and İnandıktepe Level III (Mielke 2006: 258–59). Slightly different solutions were adopted at Kuşaklı-Sarissa where a semi-subterranean granary with a triangular plan was in function during Period I and II (Mielke 2001: 237–40). Finally, in a short communication, the presence of an underground silo in the Hittite levels of Çadır Höyük was suggested (Gorny 2004: 18–19; Steadman and McMahon 2015: 93).

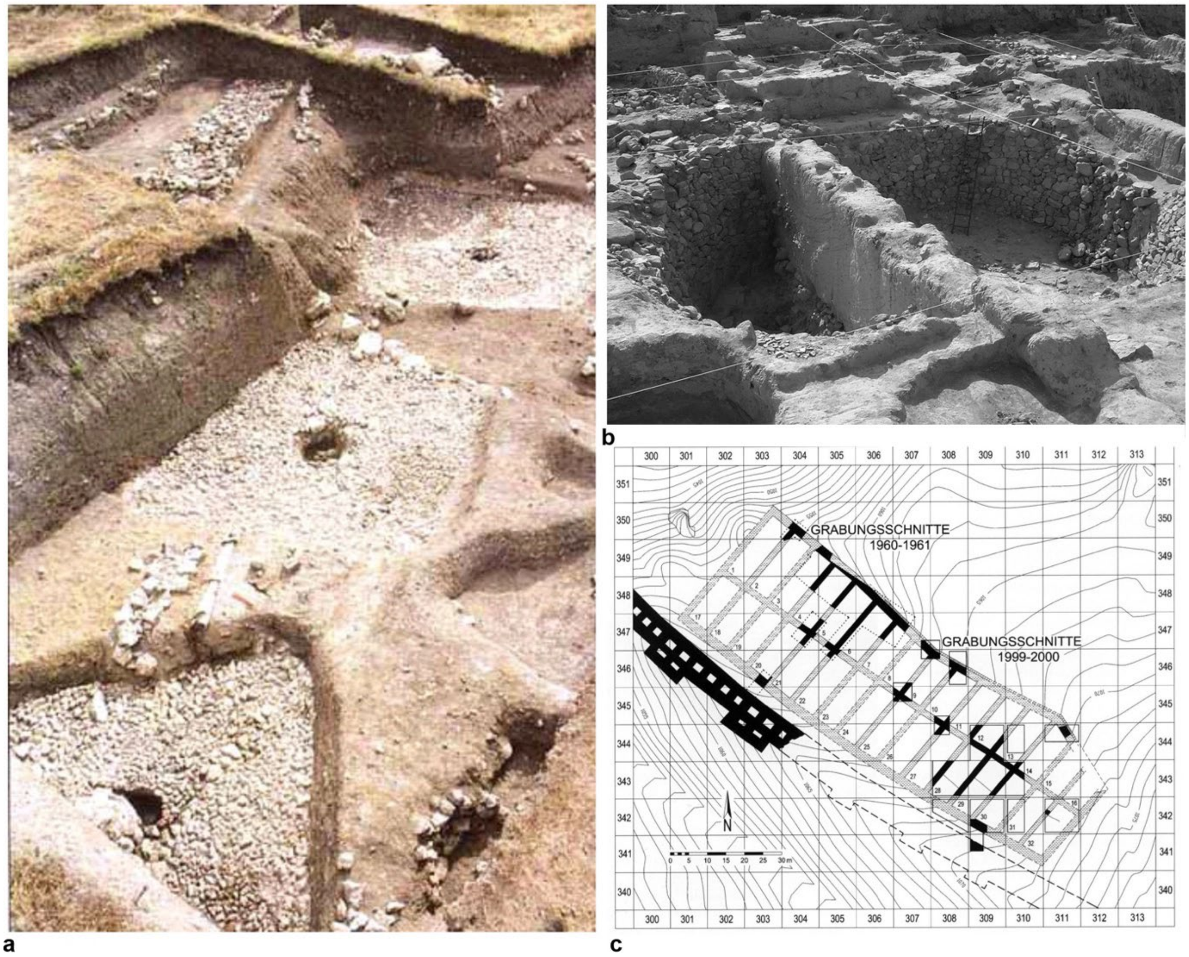

a
b
c
300 301 302 303 304 305 306 307 308 309 310 311 312 313
351 350 349 348 347 346 345 344 343 342 341 340
GRABUNGSSCHNITTE
1960-1961
GRABUNGSSCHNITTE
1999-2000
N
0 5 10 15 20 25 30 m

Figure 4.18 – *Examples of Anatolian LBA large-scale storage facilities:* (*a*), *bottom of the silo-pits located on the outcrop of Büyükkaya, at Bogazköy*-Hattuša (*www.daist.com*); (*b*), *silo at the site of Kaman-Kalehöyük* (*Glatz 2020*)*;* (*c*)*, Silocomplex in the Lower City of Bogazköy*-Hattuša (*10 m grid*) (*Seeher 2000*).

In short, the centralized accumulation of large quantities of staple products clearly emerges as a characteristic hallmark of Late Bronze Age (Hittite) Anatolia – with almost all the main excavated sites within the bend of the Kızılırmak River housing storage facilities purposely built to store impressive quantities of crops (for reconstructed figures see Seeher 2000: 292–93; Mielke 2001: 241; Fairbain-Omura 2005: Tab. 2).

The dimensions and usability of those structures, together with their capillary distribution in the core region of the Empire (Figure 4.17), must be understood as part of a planned economic strategy, aimed to extract and accumulate large quantities of agricultural surplus. Despite the general lack of administrative documentation concerning the functioning of those structures, other textual sources provide glimpses of the administrative system behind this network of storage facilities. The main evidence in this regard is the Edict of Telipinu (CTH 19), issued by the eponymous great king in the late 16th century BCE: a text aimed, among other things, to reform the network of "houses of the seal" – administrative centers under the control of a specific administrator (LUAGRIG) who managed the royal estates and collected state revenues (Singer 1984; Matessi 2016).

Seeher (2015: 197) advanced the possibility that the Hittite system of large-scale storage might have originated from an older tradition stemming from the large urban centers of the Old Assyrian Colony Period. This hypothesis might be supported by the possible presence of a large-scale silo from the citadel of Kültepe, dated to Levels 10–9 (ca. 2050–1950 BCE) (Kulakoğlu et al. 2013: 46). This structure was, however, later reinterpreted as a garbage pit and omitted from the discussion of the Early Bronze Age architecture (Ezer 2014: 20). Alternatively, Schachner (2017: 40) considered the possibility of a local “Hattian” origin for these types of structures. In this scenario, the large quantity of underground storage facilities found at the Middle Bronze Age site of Resuloğlu (Yıldırım 2012: fig. 1), in turn recalling Early Bronze Age examples from Demirci Hüyük (Korfmann 1983: fig. 343), are seen as a forerunner of the Hittite storage system. As far as storage is concerned, we should, however, point out that these latter examples are functionally and structurally different than the later Hittite large-scale facilities: both at Demirci Hüyük and Resuloğlu relatively large quantities of staple products are stored in a large number of medium-to-small sized silo-pits, which on several levels is radically different from storing large quantities of staple products in single large-scale structures. Hence, if the technology for anoxic underground storage was known, as largely expected, in the older Anatolian tradition, what it might have been missing, before the Hittite Kingdom, is the presence of a central institution either interested or able to extract and manage large quantities of agricultural surplus – possibly reflecting an older Central Anatolian emphasis on wealth rather than staple finances (Frangipane 2012: 116–17).

4.3.2 *Post-Hittite large-scale storage: textual and archaeological evidence*

If the centralized accumulation of grains appears as a characteristic feature of the Hittite period and the associated political economy, the fall of Ḫattuša must have had an impact on this network of large-scale storage. During the Early Iron Age there is strong evidence for storage located on citadel mounds, but in the form of an extensive pitting activity regarded as evidence for discontinuity with previous monumental developments. Those pits, unstructured and small in size, have been connected with storage activities at a range of sites, including Kinet Höyük Period 12 (Gates 2013a: 493–94), Tell Tayinat Field Phase 6 and 5 (Harrison 2010: 87–88), the LBA-IA transitional levels from Tarsus-Gözlükule (Goldman 1956: 58–59), EIA levels at Çadır Höyük (Ross 2010: 68–69), Yassıhöyük phase

YHSS 7 (Voigt and Henrickson 2000: 41), and EIA levels at Oymaağaç Höyük (Czichon et al. 2016: 64–68). This evidence is interpreted as an indication for "regression" from centralized to household agropastoral economies (Gates 2013b: 101). While such development is, no doubt, representative of the ongoing changes during the Late Bronze to Iron Age transition, it nonetheless only applies to some areas of the former Hittite Empire. Conversely, we may hypothesize that in other regions a Late Bronze Age tradition of centralized storage partially survives into the Iron Age – expressed by large-scale well-constructed storage structures located in well-planned urban contexts. I propose to interpret the data from Niğde-Kınık Höyük along those lines, as further confirmed by additional archaeological evidence from Arslantepe-Melid period IIIB, Tille Höyük Level IV and V, and possibly Kilise Tepe Level 2 (Figure 4.19).

Three large silo-pits were recently unearthed in the northeastern excavation area of Arslantepe. Those structures are plastered with straw, with a maximum diameter of ca. 4 m and a depth exceeding 1.5 m (Manuelli, *pers. comm.*). The silos of Arslantepe are attributed to Phase 3-Level 7, dated to an early phase of Early Iron Age II (ca. 1000–900 BCE) (Manuelli 2020). Liverani initially interpreted this phase as part of a squatter's occupation (2012: 332 and 339–40), but now these silos are considered indicative of a change in the function of the area as it became devoted to storage activities (Manuelli 2020). A possible second archaeological case of Iron Age large-scale storage comes from the site of Tille Höyük on the Upper Euphrates. According to Blaylock, both in Level IV (dated to the late 10th to early 9th century BCE) and Level V (dated to the 9th century BCE), large, structured pits associated with substantial architecture may be interpreted as large-scale storage facilities (Blaylock 2009: 87–126). In Level IV, deep and well-constructed silo-pits – lined with mudbricks, with paved bottoms, and with remains of chaff plaster – are documented in Building II and in the remains of Building V (Blaylock 2009: 102). The evidence from Level V comes from the precincts of Buildings II and III: a rectangular stone and mud-brick lined silo-pit and an oval stone lined silo-pit (Blaylock 2009: 110). Finally, additional examples – slightly later, but worth mentioning – come from the site of Kilise Tepe, in the Göksu Valley (Postgate and Thomas 2007; Postgate 2017). During the Iron Age occupation (Level 2), the so-called "Central Strip" is described as an open space, regularly cut by storage pits – identified as such according to the presence of coating layers of phytoliths (Heffron et al. 2017: 107). Beside the almost ubiquitous presence of negative storage facilities of medium to small dimensions, relevant for our purposes are the storage structures from Surface 1 (Heffron et al. 2017: 134–42), dated to the latest Iron Age occupation of the site from 800 to 650 BCE (Postgate 2017: Tab. 1). During this phase two large-scale rectangular silos were built – respectively 3.55x3.80 m and 2.60 m deep (structure P09/55), and 8.0x4.5 m and 3 m deep (structure P11/11). Those two large structures were present together with other circular storage pits of more modest but still significant dimensions (Heffron et al. 2017: 134–42).[26]

In addition to the archaeological record, evidence of large-scale grain storage in post-Hittite Anatolia can also be found in the epigraphic record. In fact, in the Iron Age Anatolian hieroglyphic corpus we find a relatively frequent attestation of granaries, indicated by the Luwian word *karuna/kaluna* associated with the determinative sign *255/*256 (Marazzi 1998: 103 n. 3) (Figure 4.20). An interesting point comes from the iconography of the sign *255/*256, depicted as a rectangle/square with a small circle/square in the center and translated as the determinative sign for granary (Figure

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[26] A large-scale silo dating to the IA I has been identified during recent fieldwork conducted at Karkemish (Bolognani 2017: 63-64). This evidence is to date still unpublished.

4.20). As already noticed by van den Hout (2010: 237), the sign recalls a planimetric rendering of a silo-pit with a drainage hole in the middle, closely resembling underground storage structures such as the ones previously described from Late Bronze Age Boğazköy (Figure 4.18,a and 4.20). It is, therefore, possible that the pictographic value of the sign *255/*256 connects the concept of storage with the underground structures here discussed. The hieroglyphic sign *255/*256 is today attested in 6 published inscriptions, all dated to the Iron Age: KARKAMIŠ A30h (CHLI II.42), AHMAR 5 (CHLI III.3), MARAŞ 8 (CHLI IV.1), ISKENDERUN (CHLI IV.3), HAMA 8 (CHLI IX.6), and KARATEPE 1 (CHLI I.1) (Figure 4.19).

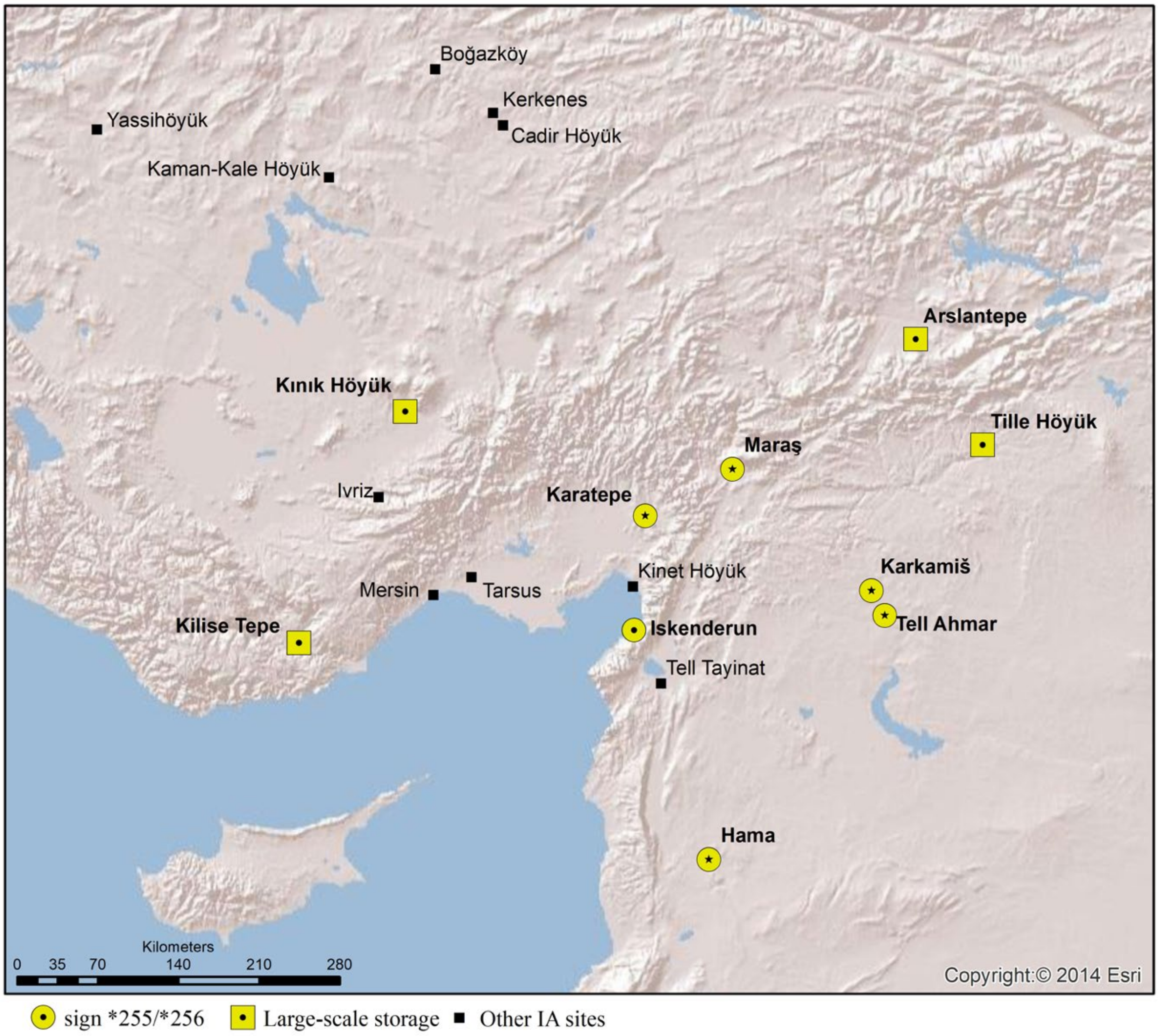
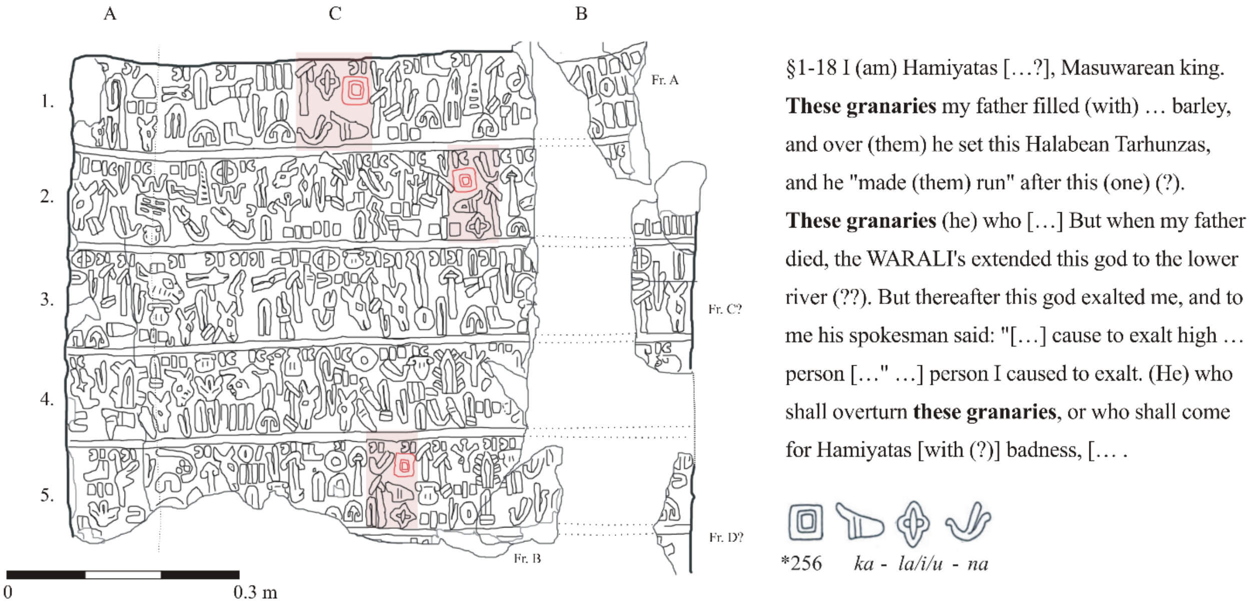

Boğazköy
Kerkenes
Cadir Höyük
Yassihöyük
Kaman-Kale Höyük
Arslantepe
Kınık Höyük
Tille Höyük
Maraş
Ivriz
Karatepe
Kinet Höyük
Karkamiš
Mersin
Tarsus
Kilise Tepe
Iskenderun
Tell Ahmar
Tell Tayinat
Hama
Kilometers
0 35 70 140 210 280
Copyright:© 2014 Esri
sign *255/*256
Large-scale storage
Other IA sites

Figure 4.19 – *Iron Age evidence of large-scale storage facilities. The map presents both the epigraphic evidence and the archaeologically known large-scale silos. Other sites mentioned in the text are marked.*

KARKAMIŠ A30h is an inscription of archaic (12th to 11th century BCE) or archaizing (10th to 9th century BCE) date, mentioning the filling of a granary (Hawkins 2000: 177–78). In AHMAR 5 the local king (Hamiyatas, tentatively dated to the late 10th to early 9th century BCE), eulogizes his father for having dedicated granaries to the Storm God of Aleppo (Hawkins 2000: 231–34) (Figure 4.20). In MARAŞ 8, the ruler of the kingdom of Gurgum-Marqas (identified as Laramas I, tentatively dated to the 10th century BCE) celebrates the filling of granaries (Hawkins 2000: 252–55). In the inscription of ISKENDERUN, a later king of Gurgum-Marqas (Laramas II, tentatively dated to the late 9th century) reports the dedication of a granary in an inscription on a stone shaped like a grinding-stone. In HAMA 8 the local king Urhilina (tentatively dated to the mid-9th century BCE) celebrates the construction of a granary (Hawkins 2000: 409–10). Finally, in the Karatepe Luwian-Phoenician bilingual (KARATEPE 1, generally dated to the turn of the 8th century), the filling of granaries is mentioned (Hawkins 2000: 45–68).



§1-18 I (am) Hamiyatas […?], Masuwarean king. **These granaries** my father filled (with) … barley, and over (them) he set this Halabean Tarhunzas, and he "made (them) run" after this (one) (?). **These granaries** (he) who […] But when my father died, the WARALI's extended this god to the lower river (??). But thereafter this god exalted me, and to me his spokesman said: "[…] cause to exalt high … person […" …] person I caused to exalt. (He) who shall overturn **these granaries**, or who shall come for Hamiyatas [with (?)] badness, [… .

Figure 4.20 – *TELL AHMAR 5 copy of the inscription and translation, references to granaries are highlighted (drawing from Hawkins 2000: 232 and pl. 69).*

This relatively frequent mention of the filling of granaries in the hieroglyphic corpus has a clear and indisputable literary component (Simon 2011), possibly connected to a reformulation of the ideology of power and the development of a new self-celebratory rhetoric, centered on the topos of abundance and the idealized figure of the "good ruler" (e.g., Masetti-Rouault 2004). Recent research has suggested that this literary motif of accumulation of large quantities of cereals by the central authority might have resulted from a growing interaction between the Syro-Anatolian polities and Assyria (Balza 2017). This hypothesis is based on the presence in Assyria of a similar literary motif, first attested in the Annals of Tiglath-Pileser I (ca. 1114–1076 BCE) and documented with a degree of continuity from the reign of Aššur-Dan II (ca. 934–912 BCE). Without delving deeper into the topic, problematic aspects of which have already been pointed out by Balza (2017), the archaeological evidence previously presented makes clear that in northern Syria and southern Anatolia this literary motif cannot be reduced to a purely abstract discourse, but rather reflects an economic reality in which the accumulation of large quantities of staple products was a central component. Hence, centralized storage appears as a crucial feature of Early-Middle Iron Age northern Syria and southern Anatolia, both in the economies of those polities and in the rhetoric of the self-celebrative program carried out by their rulers.

4.3.3 *Interpreting the evidence of large-scale storage from Niğde-Kınık Höyük*

In the Anatolian Plateau, large-scale centralized storage emerges as a distinctive feature of the Hittite period, suggesting that staple products played a crucial role in the Late Bronze Age political economy. This development reversed a long-standing Central Anatolian focus on wealth finances characteristic of the pre-Hittite periods (Frangipane 2012: 116–17). In this framework, large-scale granaries, a recurrent urban feature of the "Hittite city" (Mielke 2011: 176–78), may be understood as part of a broader agricultural-infrastructural program (Schachner 2009: 18–21), aimed to maximize and stabilize the production in a climatically (e.g., Kuzucuoğlu 2015) and politically (e.g., van den Hout 2007: 394–96) volatile scenario. My analysis advanced the hypothesis of a partial survival of this particular Late Bronze Age economic system beyond the end of the Hittite Empire. This conclusion was reached on the basis of Iron Age archaeological evidence of large-scale storage (Niğde-Kınık Höyük, Arslantepe, Tille Höyük, and Kilise Tepe), matched by the attested granaries in the contemporaneous epigraphic record (*255/*256 karuna/kaluna). The geographic distribution of those attestations broadly overlaps with the regions – the former southern and eastern peripheries of the Empire – in which continuity between the Late Bronze and Iron Ages has already been demonstrated in other respects. It is, therefore, tempting to include centralized large-scale storage among the distinctive features of Hittite tradition that survived the end of the Late Bronze Age in those regions – together with hieroglyphic writing, artistic style, architectural features, and religious beliefs.

In addition to reinforcing the degree of continuity between the two historical phases, the recognition of an Iron Age large-scale storage tradition directly derived from the previous Hittite system provides insights into both the modality and nature of this continuity, which constitutes the subject of long-lasting debate. Traditionally, scholarship has emphasized the politico-ideological nature of this continuity, driven by the long-standing focus on evidence from Karkemish and evident in the well-known presence of Hittite-derived elements in political rhetoric and public display. The recognition of a partial continuity in economic structures between the Hittite and post-Hittite phases allows us to assume a degree of survival of the underlying institutional and administrative system, aimed to extract and manage the stored products.

This scenario supports the already formulated hypothesis of a determinant role of the peripheral Hittite administration in the transmission of Hittite heritage into the first millennium BCE – crucial especially in those regions, like South-Central Anatolia, in which dynastic continuity is unattested (Mora and d'Alfonso 2012a). In those terms, the aforementioned economic structure, together with its administrative and infrastructural apparatus, may be understood not as the simple result of continuity but instead as an active element in promoting and determining those historical processes.

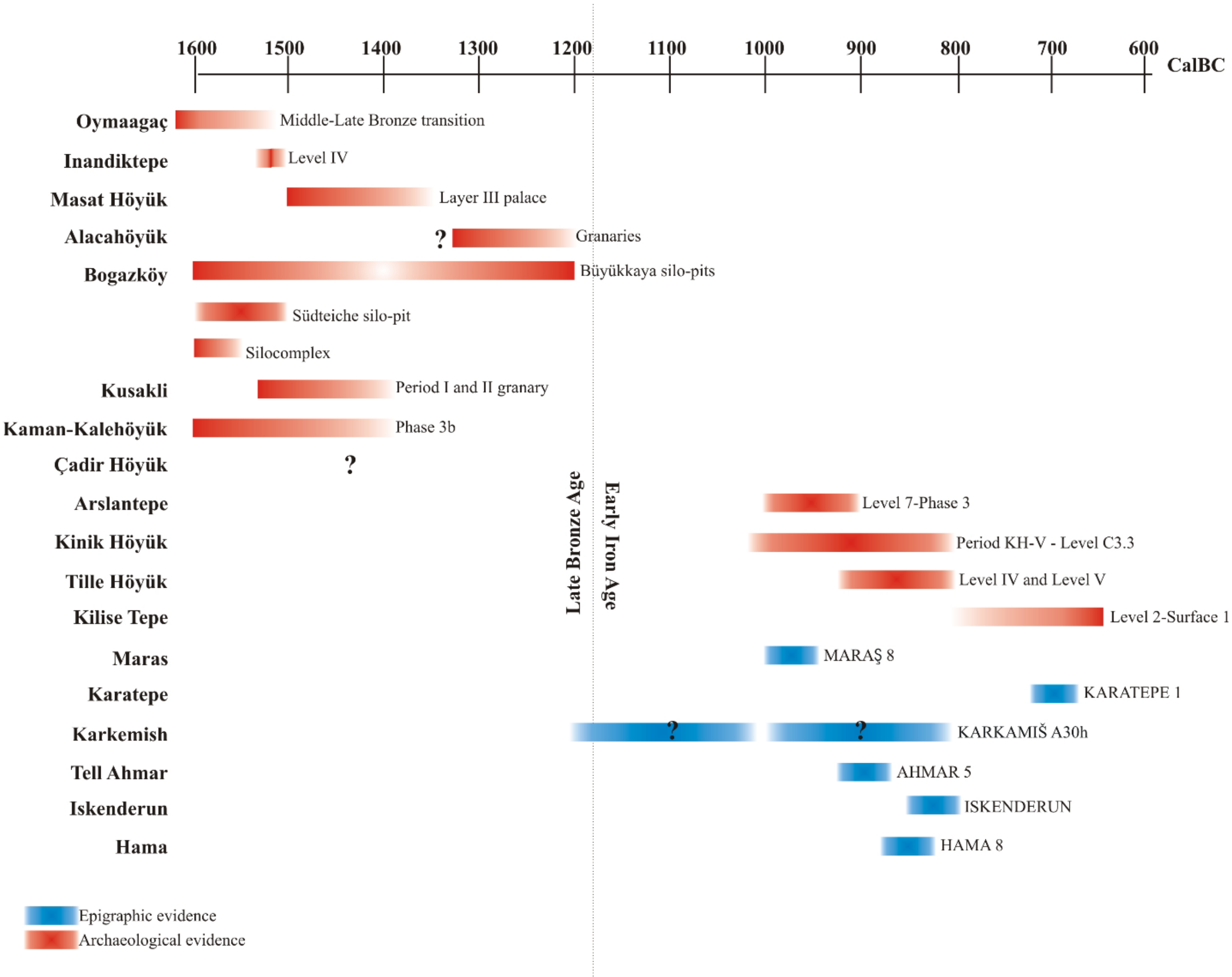


Figure 4.21 – *Chronological distribution of storage infrastructure, attested in the epigraphic and archaeological record. The chronology of the inscriptions is taken from Hawkins 2000; the chronology of the archaeological structures is tentative and based on the most updated periodization (see text for references).*

Today, a detailed chronological analysis of the Iron Age evidence for large-scale storage is still hampered by our limited and somewhat superficial knowledge of the Early Iron Age, coupled with problems in dating the epigraphic evidence. There remains a chronological gap of as much as one or two centuries between the fall of the Empire and the earliest Iron Age evidence of large-scale storage – which, excluding the chronologically problematic inscription of KARKAMIŠ A30h (Hawkins 2000: 177–78), dates to the first half of the tenth century BCE (Figure 4.21). This hiatus, however, may be an artefact of the aforementioned lacunae in our knowledge of the twelfth and eleventh centuries BCE. In fact, despite the overall paucity of data for those centuries, some degree of political activity is testified by epigraphic data from the Middle-Upper Euphrates (Hawkins 1988) and South-Central Anatolia (Hawkins 2000: 426; d'Alfonso and Payne 2016: 122), which provides a possible historical context crucial to the transmission of the described economic and administrative system.

In contrast to southern Cappadocia and the Upper-Middle Euphrates, a different picture emerges in northcentral and northwestern Anatolia. In the former core of the Empire and its western periphery, large-scale storage facilities are to date unattested during the Early-Middle Iron Age, as indicated by data coming from, among other sites, Boğazköy (Genz 2004) and Yassıhöyük-Gordion (Krsmanovic 2017). This evidence seems to confirm the already hypothesized economic focus of the Early Phrygian polity on metallurgy and textile production (Burke 2005), with an apparent lack of interest in centralized long-term accumulation of large quantities of staple products. Hence, in contrast to the southern and eastern areas of the plateau, northcentral and northwestern Anatolia seem to shift during the Iron Age to forms of wealth finance (sensu d'Altroy and Earle 1985). This shift must be connected to the broader material culture change documented in those regions with the beginning of the Iron Age. Paradoxically, the evidence discussed here fits well with both positions on the opposite ends of the debate about the nature of those changes: the migratory model (Voigt and Henrickson 2000) and the thesis of an autochthonous development of local traditions which resurface after the fall of the Empire (Genz 2005). Indeed, if on one hand it is tempting to connect this shift to economic changes due to the arrival of external populations bringing a new economic organization, on the other hand the same evidence recalls forms of wealth finances characteristic of the pre-Hittite polities in those regions (Frangipane 2012: 116–17). Clearly, for northcentral and northwestern Anatolia further research on the topic is necessary, locating the case study discussed here within a holistic analysis of the Iron Age record and considering the longue durée of the Anatolian economic structures. More coherent is the picture emerging from southcentral Anatolia, for which we were able to explain the economic evidence in historical terms. Of course, the proposed reconstruction is and remains a working hypothesis, especially in light of the major gaps still present in the record. It is, however, clear that this research direction can provide important insights for our understanding of the complex dynamics affecting Anatolia and northern Syria in this crucial historical period. Only future archaeological research will disentangle this complexity further.

4.4 Summary

Storage is a central feature of agricultural systems, connected to the economic and institutional organization of production, extraction, and redistribution/consumption of agricultural staples. In this chapter, I have presented the evidence for large-scale storage from the southern slope (Operation C, Sector C3) from the mound of Niğde-Kınık Höyük. Within the excavation area, two large silo pits have been intercepted: Silo C2522 a circular/elliptical structure, having a reconstructed diameter of nearly 8 m and a minimum preserved depth of about 3 m; and Silo C2884, a double-chambered structure, with a hypothetical reconstructed footprint of ca. 15 x 7 m, and a minimum preserved depth of 2.4 m. The use-phase of these structures is radiocarbon-dated to the 10th century BCE, contemporaneous with an attribution of these structures to Period KH-P VA (1000-800 BCE). The reconstructed dimensions of those structures unequivocally indicate facilities purposely built for the storage of a large quantity of staples far exceeding domestic demands. It is noteworthy that these silos are housed in a well-planned urban context within the citadel and in proximity to the defensive walls. This evidence allows me to reconstruct the presence at Niğde-Kınık Höyük in the early 1st millennium BCE of an institution able to extract and accumulate large quantities of staple products. Agriculture appears, thus, to have represented a pivotal component of the local economy. In the second part of the chapter, the evidence from Niğde-Kınık Höyük has been contextualized within a broader geographic and chronological context. The combined analysis of the archaeological and epigraphic record allowed me to hypothesize that a distinctive "Hittite" tradition of centralized accumulation and redistribution of agricultural products survived the end of the Late Bronze Age in the former southern and eastern peripheries of the Empire.

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In this chapter I have reconstructed, based on archaeological evidence, the central importance of agriculture in the local Iron Age political economy. Which staples were stored in these granaries? More in general, which crops were part of this agricultural system? In which landscape these agricultural activities took place? Was the local environment impacted by these activities? Was agricultural central in the local political economy also during the earlier and later periods? Which diachronic trends can we reconstruct? In order to answer these questions, in the next two chapters I will present and discuss the results of the archaeobotanical study, conducted on wood charcoal (Chapter 5) and seed/fruit remains (Chapter 6).

CHAPTER 5

Wood charcoal analysis: woodland vegetation, arboriculture, and firewood exploitation in southern Cappadocia in the late 2nd and 1st millennia BCE

Having introduced southern Cappadocia (Chapter 3) and the granaries from Niğde-Kınık Höyük (Chapter 4), in this chapter I will present and discuss the results of the wood charcoal study conducted at the latter site. This study represents the first original archaeobotanical dataset produced in the framework of the dissertation. The results of the wood charcoal study conducted at Niğde-Kınık Höyük have been already published (Castellano 2021). Passages from Sections 5.2, 5.3, 5.4, and 5.5 are quoted verbatim from the latter publication, which originated from the dissertation project. Some changes were, however, necessary: in this chapter it has been considered more adequate to further narrow the chronological resolution in use, by dividing period KH-P V into VA (800 – 1000 BCE) and VB (1200 – 1000 BCE), a distinction which is not present in Castellano 2021. The Roman occupation of the site (KH-P IIA) was identified only after the publication of Castellano 2021; accordingly, two samples have been reassigned to this later occupation period – although, both samples contain a negligible number of charcoal fragments, and thus do not impact whatsoever the interpretation provided in the earlier publication.

5.1 Introduction: wood charcoal analysis at Niğde-Kınık Höyük

Wood represented an important resources in the pre-modern world (e.g., Perlin 2005), used for activities ranging from construction, manufacture, heating, lighting, and cooking. Accordingly, charcoal fragments resulting from combustion processes, either intentional or unintentional, are one of the most ubiquitous components of archaeological sediments. The quantitative study of these remains can yield two sets of information, providing insights on both the activities in which wood was employed, informing on past behavior, economy, and more broadly, lifeways (e.g., Marston 2017, 61-63); and on the woody vegetation present in the surroundings of the settlement, thus illuminating on past environments and landscapes (e.g., Asouti and Austin 2005). Anthracology is the subfield of archaeobotany focusing on the study of wood charcoal (Vernet 1992). For a general introduction to the field, including the main theoretical and methodological assumptions, I refer the reader back to Section 2.1.1.

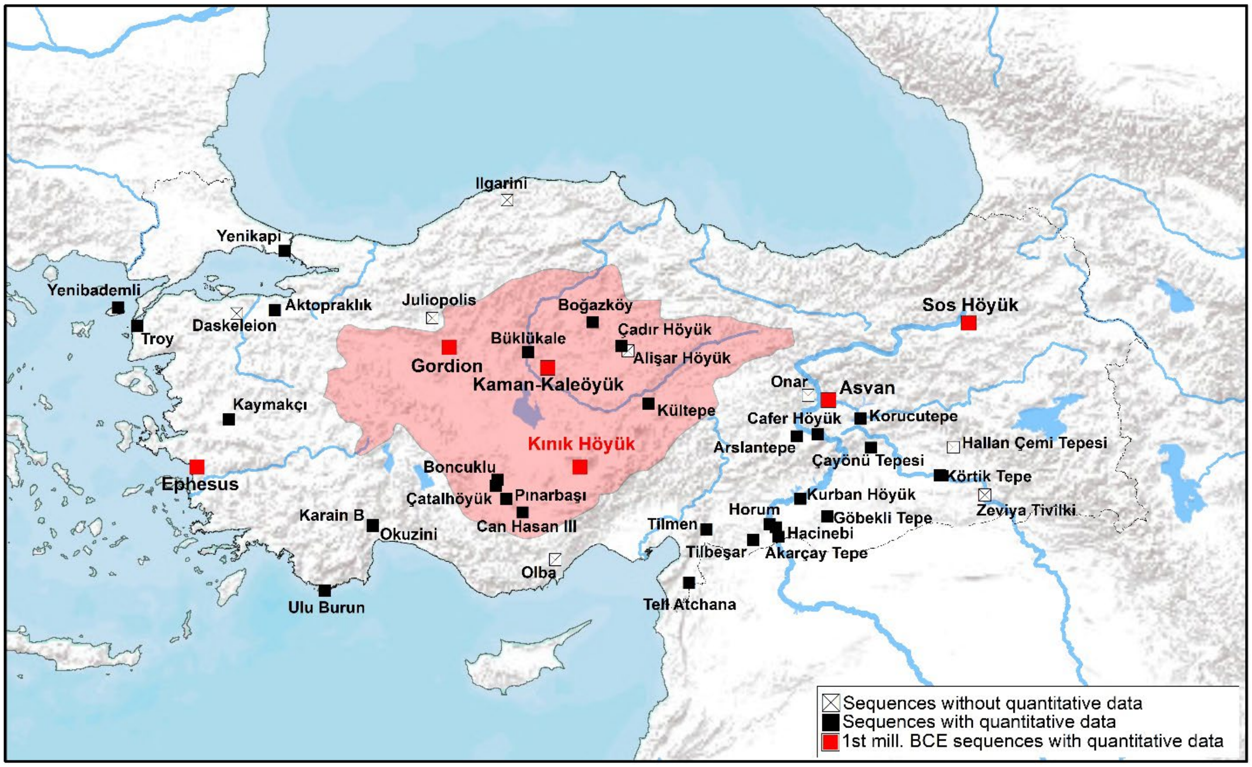

Ilgarini
Yenikapı
Yenibademli
Aktopraklık
Juliopolis
Boğazköy
Sos Höyük
Troy
Daskeleion
Büklükale
Çadır Höyük
Alişar Höyük
Gordion
Kaman-Kaleöyük
Onar
Asvan
Kaymakçı
Kültepe
Cafer Höyük
Korucutepe
Kınık Höyük
Arslantepe
Hallan Çemi Tepesi
Çayönü Tepesi
Boncuklu
Ephesus
Körtik Tepe
Çatalhöyük
Pınarbaşı
Kurban Höyük
Zeviya Tivilki
Karain B
Horum
Göbekli Tepe
Okuzini
Can Hasan III
Tilmen
Hacınebi
Tilbeşar
Akarçay Tepe
Olba
Ulu Burun
Tell Atchana
☒ Sequences without quantitative data
■ Sequences with quantitative data
🟥 1st mill. BCE sequences with quantitative data

Figure 5.1 – *Location of Niğde-Kınık Höyük and of other published anthracological (wood charcoal) and xylological (wood) sequences from modern Turkey. The Central Anatolian Plateau is highlighted. The red squares indicate the published 1st millennium BCE anthracological sequences.*

The anthracological study presented in this chapter represents the first component of the archaeobotanical project conducted at Niğde-Kınık Höyük (Figure 5.1). A total of 6779 charcoal fragments extracted from 174 samples were analyzed, aiming at reconstructing firewood exploitation strategies and vegetation history in the time period comprising the Late Bronze Age to the Early Ottoman occupation. An introduction to the site, and its historical and environmental context is provided in Section 3.4.3, to which I refer you for further information.

5.2 Materials and Methods

5.2.1 *Sampling strategy*

The study presented in this chapter is based on 174 flotation samples, corresponding to more than 2214 liters of processed sediment. Context size permitting, samples were collected as 3 to 5 large plastic bags of sediment for each sampled stratigraphic unit, averaging roughly 13 liters/sample. The sample size of 10-15 liters was chosen following a preliminary evaluation of the average content of botanical macroremains (wood charcoal and seed/fruit), and with the aim of sampling a diverse set of areas and contexts across the site. Samples were processed through manual (wash-over technique and bucket flotation; Pearsall 2005) and machine-assisted (Siraf-Type flotation machine; Williams 1973) flotation (Appendix 3), the latter introduced by the author at a successive stage in the project. Once extracted and dried, the organic floated debris was sorted through 4-, 2-, 1-, 0.5-, and 0.25-mm geological sieves.

Samples were selected in order to represent the different occupation periods (Section 3.4.3, Table 3.1 and 3.2), operations (Section 3.4.3, Figure 3.18), and depositional contexts exposed to date. Table 5.1 summarizes the number of samples available for each occupation period, excavation area, and stratigraphic context type. Detailed sample-by-sample information is provided in Appendix 3. The availability of samples from the Bronze Age occupation periods (KH-P VIII, KH-P VI, and KH-P VI) is conditioned by the currently limited exposure of those levels (d'Alfonso and Castellano 2018). No samples are currently available for the Middle (KH-P VII) and Early (KH-P VIII) Bronze Ages, while only two samples are available for the Late Bronze Age (KH-P VI). The Early-Middle Iron Age deposits are represented by a higher, whilst still limited, number of samples – respectively nine for KH-P VB and ten samples for KH-P VA. A more sizable number of samples is available for the other occupation periods, with the sole exception of the Roman levels (KH-P IIA), which have been only recently located at the site (Figure 5.2, Table 5.1).

KH-Period	Conventional Period	Date	Samples (charcoal)	Samples provenience
KH-P I	Seljuk/Early Ottoman	1200 – 1450 CE	25 (444)	Excavation area: B (25) Long-term deposits (17), short-term deposits (8)
KH-P IIA	Roman	1 – 300 CE	2 (45)	Excavation areas: A (2) Short-term deposits (2)
KH-P IIB	Late Hellenistic	200 – 1 BCE	39 (1356)	Excavation areas: A (17), B (19), D (3) Long-term deposits (21), short-term deposits (18)
KH-P III	Achaemenid/Hellenistic	500 – 200 BCE	56 (2328)	Excavation areas: A (24), B (13), D (19) Long-term deposits (32), short-term deposits (20)
KH-P IV	Neo Hittite and LIA I	800 – 500 BCE	31 (1461)	Excavation areas: A (8), C (23) Long-term deposits (25) short-term deposits (6)
KH-P V	Post Hittite (EIA and MIA I)	1200 – 800 BCE	19 (1049)	Excavation areas: A (6), C (13) Long-term deposits (17), short-term deposts (2)
KH-P VI	Late Bronze Age (LBA)	1500 – 1200 BCE	2 (92)	Excavation area: C (2) Long-term deposits (2)
KH-P VII	Middle Bronze Age (MBA)	2000 – 1600 BCE	—	No samples availlable to date
KH-P VIII	Early Bronze Age (EBA)	3000 – 2000 BCE	—	No samples availlable to date

Table 5.1 – *Kınık Höyük occupation periods and number of samples and charcoal fragments considered in this study. Sample-by-sample information on provenience, preparations, volumes, and number of charcoal fragments analyzed is provided in Appendix 3.*

The samples included in this research originated from the different excavation areas (Figure 5.2, Table 5.1); although thus far not all the occupation periods are either present or reached in all the trenches (d'Alfonso and Castellano 2018). Late Bronze Age samples are to date available only from Operation C (Trench C3). While Iron Age samples originates from Operation C (Trench C3) and

Operation A (Trenches Awall and A2). Bronze and Iron Age materials from the lower town (Operation D) could not be included in this research, due to their very recent exposure, to which is added the impossibility of obtaining the necessary export permits. Samples dated to the second half of the 1st millennium (KH-P III and KH-P IIB) originated from Operations A (Trench A1 and Trench A2), B, and D (Trench D1). Materials attributed to this period were not available from Operation C, being that the Hellenistic and Achaemenid levels almost completely eroded on the mound slope (Section 4.1.1). Finally, Medieval (KH-P I) structures are to date exposed only in Operation B, from where, thus, originate all the materials analyzed attributed to this occupation period.

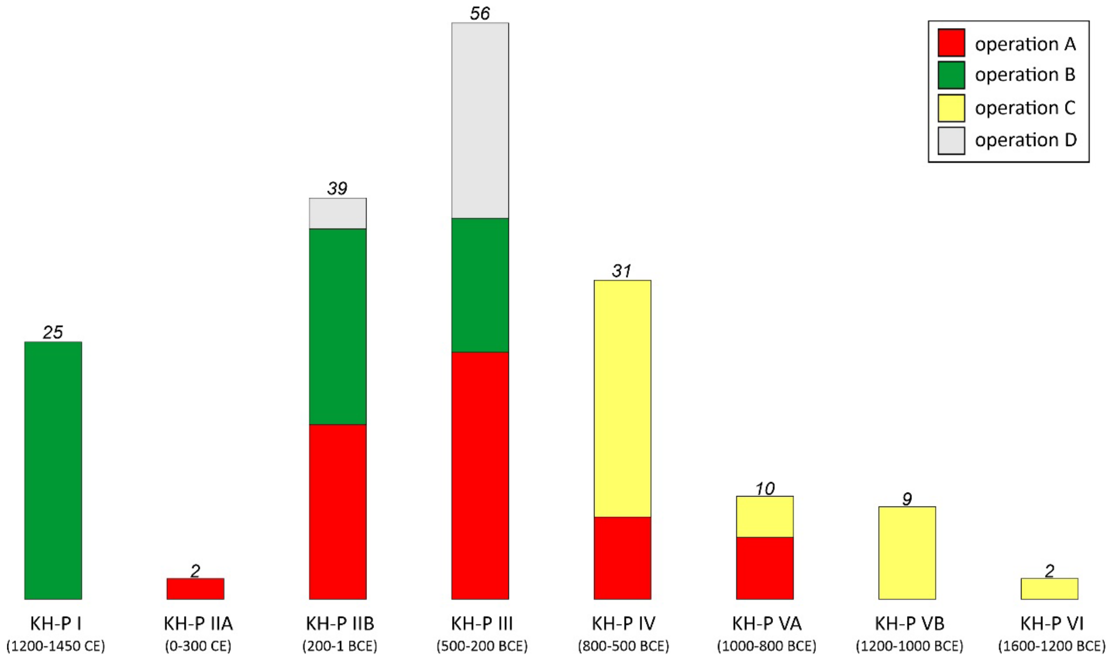


Figure 5.2 – *Kınık Höyük samples included in the anthracological study, organized by occupation periods and operation. The total number of samples for each occupation period is reported.*

In planning a sampling strategy for this study, it was decided to cover as much as possible the different array of depositional contexts exposed during the excavation. The sampling strategy adopted thus reflects the variety of stratigraphic contexts exposed through excavation. The incorporation of samples originating from different functional and depositional contexts is expected to correspond to a degree of sample-specific variability (Chabal 1992, Asouti and Austin 2005, Kabukcu and Chabal 2021), which must be accounted for in the quantitative evaluation of the results obtained. Following anthracological literature (Chabal 1992, Chabal et al. 1999, Asouti and Austin 2005), the sampled stratigraphic units are classified as long-term (here represented by accumulation layers and pit fills) and short-term (here represented by pyrotechnic structure fills, occupation layers, and burnt layers) deposits (Table 5.1, Appendix 3). The charcoal fragments found in short-term deposits correspond to in-situ concentrations resulting from single/few fire events (primary refuse), while in long-term deposits charcoal fragments are dispersed in the unit matrix (Chabal 1992) and interpreted to originate from multi-episodic depositions (secondary refuse) (Asouti and Austin 2005). The latter deposits are to be favored in order to investigate general patterns of firewood use through time (Section 2.1.1) (Chabal 1992, Chabal et al. 1999, Asouti and Austin 2005). In this study, samples from short-term contexts are used to corroborate and integrate the anthracological results from secondary refuse deposits. Furthermore, in a subsequent stage of the archaeobotanical project, a sample-by-sample comparison of anthracological and carpological data from in-situ concentrations allow me to better characterize and understand the range of pyrotechnic activities occurring at the site.

5.2.2 *Lab protocol*

Because of the abundance of medium-large sized charcoal fragments (average >4 mm fraction 6.86 g charcoal/10 liter of sediment), analysis of the 2 mm fraction was not considered necessary, reducing the number of unidentifiable fragments due to small specimen size (Asouti and Austin 2005). The study was thus conducted exclusively on the >4 mm fraction. Charcoal fragments were viewed in three sections, having been manually broken and observed under an optical episcopic microscope (Meiji MT7530) equipped with 5X, 10X, 20X, 50X lenses and a brightfield-darkfield illumination system. For part of the photographic documentation a Hitachi TM3000 tabletop scanning electron microscope was employed. For taxon identification, the author's modern reference collection (housed at New York University) and specialized literature (e.g., Schweingruber 1990, Fahn et al. 1996, Akkemik and Yaman 2012) were used. Botanical identification criteria, phytogeographic assumptions, and candidate taxa in the current Turkish flora are provided in Appendix 4.

All the charcoal fragments present in the > 4 mm fraction were analyzed, with the only exception of 15 samples subjected to subsampling: the analysis was stopped at 50 (4 samples) and 75 (1 sample) fragments in samples very strongly dominated by a single taxon (i.e., accounting for the 97-100% of the total); in 10 samples particularly rich in charcoal, the first 100 (7 samples) and 200 (3 samples) fragments were analyzed. These arbitrary cut-off values were chosen for the purpose of efficiency, considering previous anthracological research.

A 100-fragment subsample has been suggested as satisfactory to capture the floristic richness in temperate environments (Keepax 1988), whereas higher counts are to be favored in regions characterized by greater floristic diversity (Chabal et al. 1999, Asouti and Austin 2005). Recent research conducted in central Anatolia confirms the overall adequacy of a 100-fragment cut-off value; although, minor taxa can end up partially undercounted (Wright et al. 2015, 2017). The number of charcoal fragments analyzed in each sample is reported in Appendix 3, together with other quantitative data.

5.2.3 *Quantification*

Identified taxa were quantified using ubiquity, absolute count, and relative (percentage) abundance. As expected (after Chabal 1992), relative abundances calculated on the basis of weights and counts are very strongly correlated (R=0.95, Figure 5.3), with only minor discrepancies indicating atypical sample-specific taphonomic and/or depositional processes. Hence, the two values are here considered equivalent. Raw data are provided both in the form of weight and fragment count (Appendix 5), with the latter values chosen for use in figures and analysis due to their standard use in the majority of the anthracological literature. Relative (percentage) abundances were calculated including unidentifiable fragments in the sum.

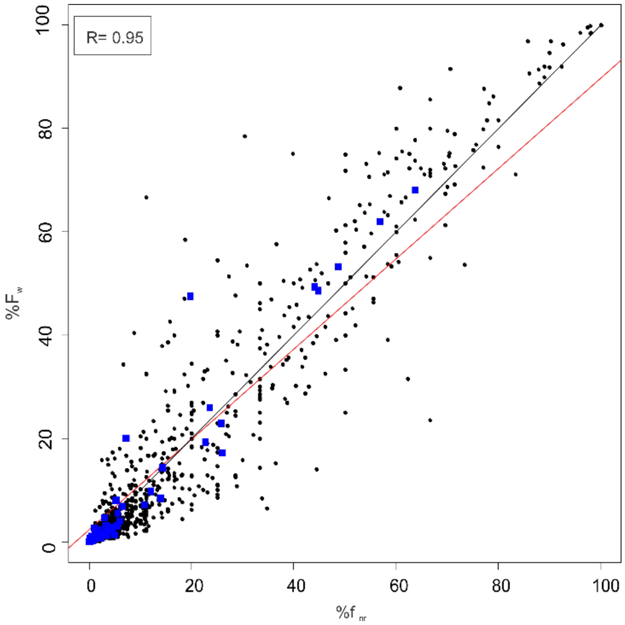


Figure 5.3 – *Correlation plot between percentages calculated on the basis of fragment counts (%Fnr) and weight (%Fw). Black dots represent single taxa within a sample, blue squares single taxa within an occupation period.*

The identified taxa are grouped following mixed ecological and economic criteria. A precise ecological grouping of the identified flora is hampered by the cosmopolitan character of several taxa and the taxonomic level of some identifications (Appendix 4). Considering those limits, taxa are assigned to six main analytical groups: (*i*) conifers, which includes all the needle-leaved trees regardless of ecology; (*ii*) cold-deciduous broadleaf forest taxa, oak dominated; (*iii*) riparian (hydrophilous) woodland vegetation, Salicaceae dominated; (*iv*) economic trees, accounting for taxa potentially bearing edible fruits/products of known economic importance in Anatolia; (*v*) woody herbs and small shrubs; and (*vi*) taxa regarded here as exotic on the basis of their current distribution and ecological requirements (Davis 1965-1985).

The anthracological results were subjected to multivariate ordination analysis, aiming to further explore the patterns and trends present in the dataset. In order to limit redundancy and noise, samples with fewer than 15 charcoal fragments analyzed were excluded from the data matrix, unsure identifications (cf.) were removed, and if needed identifications were harmonized to the lowest taxonomic level present (e.g., *Celtis* sp., *Ulmus* sp. -> Ulmaceae). Following Legendre and Birks (2012), in order to decide whether to employ a liner or unimodal ordination method, the length of the gradient in the dataset was calculated through a Detrended Correspondence Analysis (DCA). As a rule of thumb, if the gradient length is less than 2.5 SD units, a linear approach (Principal Component Analysis, PCA) might be considered appropriate, while unimodal methods (Correspondence Analysis, CA; or DCA) are generally to be favored for gradients longer than 3.0 SD (Legendre and Birks 2012). A DCA of the data matrix returned a gradient length of 2.5 SD, thus warranting the use of either a linear or unimodal method. Following testing, PCA was chosen on the basis of a better performance in explaining the variance in the dataset. Prior to the analysis, abundance count values were subjected to Hellinger transformation, a recommended step for the ordination of species abundance data through linear models (Legendre and Gallagher 2001, Borcard et al. 2011, Legendre and Birks 2012). PCA was computed on the covariance matrix. Results are presented as a correlation biplot ('scaling 2' in Oksanen et al. 2019), thus maintaining the angle between descriptor vectors (species) reflecting their correlation. Following initial screening, 6 samples highly dominated by single taxa were considered extreme values and excluded from the final computation. Multivariate analysis was carried out in R 3.5.1 package Vegan version 2.5.5 (Oksanen et al. 2019).

5.3 Results: the wood charcoal record from Niğde-Kınık Höyük

5.3.1 *The anthracological flora*

Following the aforementioned protocol, 6779 charcoal fragments from 174 samples were analyzed, resulting in the identification of 29 taxa. The identified flora is listed in Table 5.3. Wood anatomy, identification criteria, and candidate species are provided in Appendix 4.

5.3.2 *The anthracological sequence*

In the following paragraphs quantitative results (relative abundance and ubiquity) are presented for each occupation period (Section 5.4.3). Samples from short-term and long-term deposits (as defined in Section 5.2) will be discussed separately, considering the better suitability of the latter to provide general patterns of firewood use through time (Section 2.1.1) (Chabal 1992, Chabal et al. 1999, Asouti and Austin 2005). Results of the wood charcoal analysis for long-term deposit samples are reported in Table 5.3 (cumulative values for occupation period), and graphically presented in Figure 5.6 (sample-by-sample values for samples containing more than 20 charcoal fragments). Raw data (counts and weights) of all the samples analyzed (long-term and short-term) are available in Appendix 5.

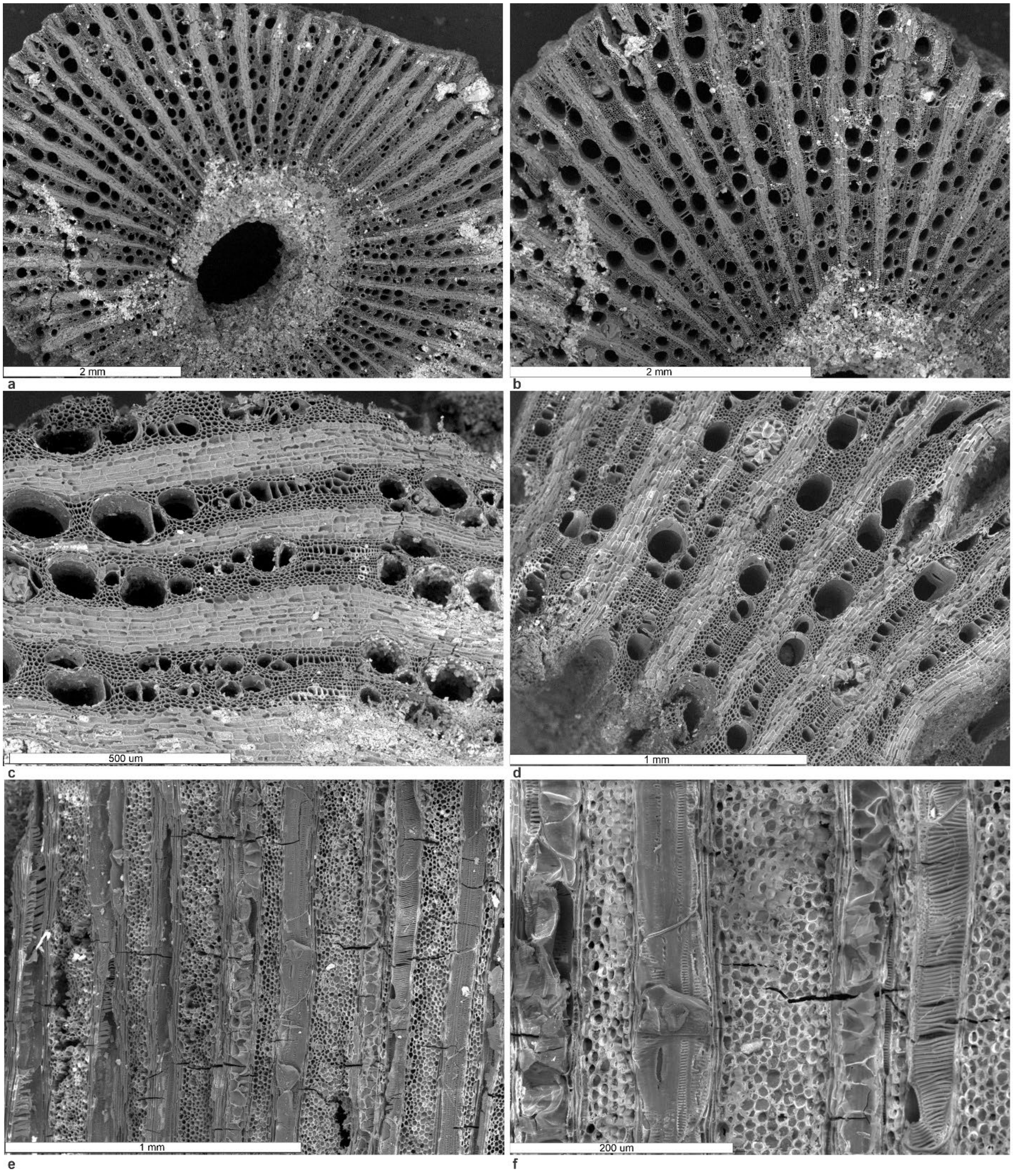


Figure 5.4 – *SEM photos of* Vitis Vinifera *(grapevine) charcoal from Kınık Höyük: (a), Transversal section, sample KIN13B608s39; note "flattened zone" with atypical porosity in the upper right corner of the image; (b), Detail of a; (c), transversal section, sampleKIN14A146s61; (d), transversal section, sample KIN18A1987s73; (e), Tangential section, sample KIN18A1987s73; (f), detail of e; note scalariform intervascular pits*

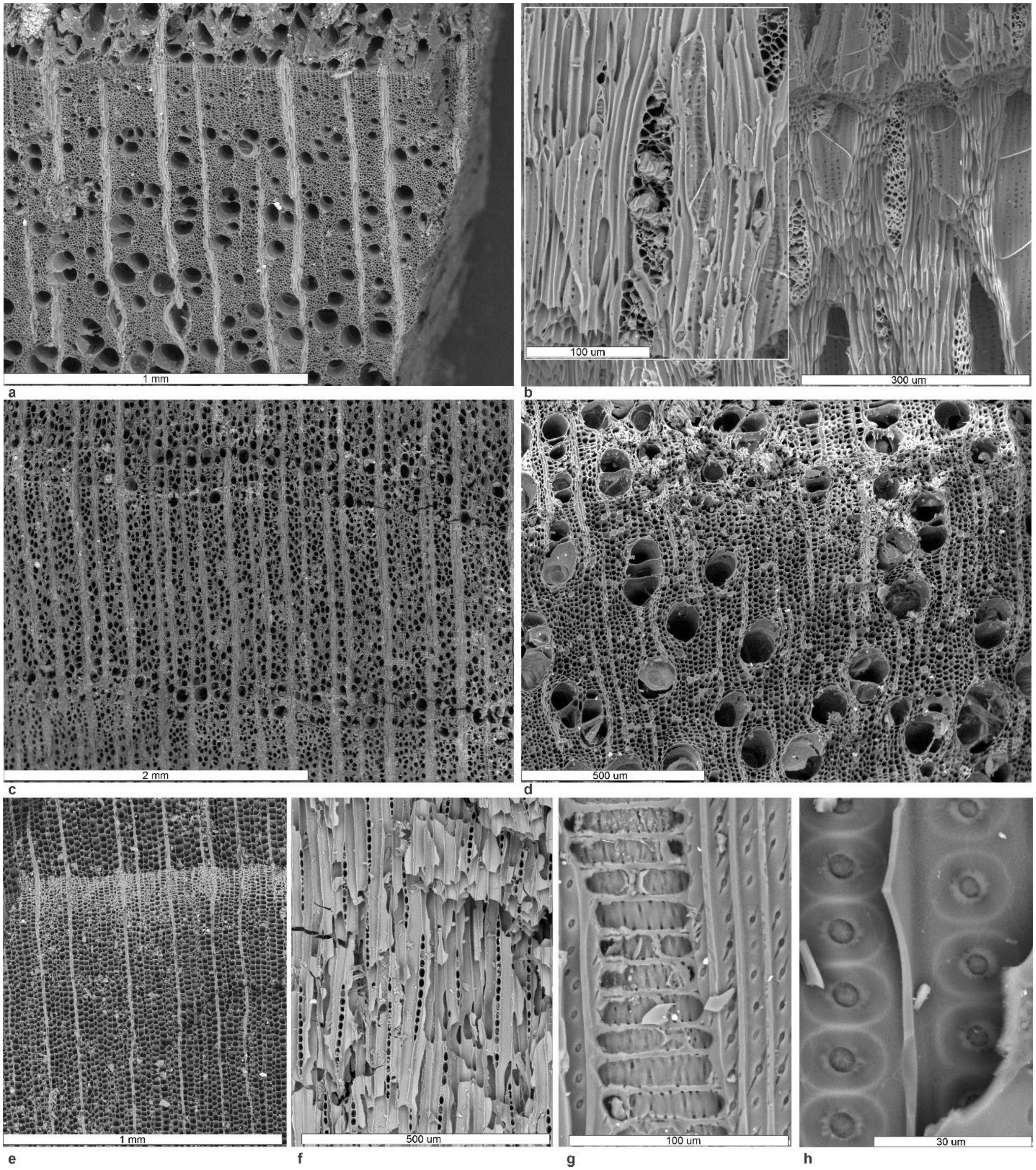


Figure 5.5 – *SEM photos of wood charcoal of selected taxa:* (*a*), *transversal section of* Elaeagnus angustifolia (*Russian olive*), *sample KIN14B870s23;* (*b*), *tangential section of* Elaeagnus angustifolia (*Russian olive*), *sample KIN14B870s23;* (*c*), *transversal section of* Amygdalus-*Type* (*almond type*), *sample KIN12B727s417;* (*d*), *transversal section of* Juglans regia (*walnut*) , *sample KIN14B2052s135a; e, transversal section of* Abies *sp.* (*fir*), *sample KIN18C2897s35;* (*f*), *tangential section of* Abies *sp.* (*fir*), *sample KIN18C2897s35;* (*g*), *radial section of* Abies *sp.* (*fir*), *sample KIN18C2897s35;* (*h*), *radial section of* Cedrus *sp.* (*cedar*), *sample KIN17C2812s39.*

Taxa	Common name	Group
Abies sp.	Fir	conifer
Cedrus sp.	Cedar	conifer
Pinus nigra -type	Scots or black pine	conifer
Pinus brutia -type	Turkish or Aleppo pine	conifer
Juniperus sp.	Juniper	conifer
Quercus spp. deciduous	Deciduous oaks	cold deciduous broadleaf forest
Hippophae rhamnoides	Seaberry	cold deciduous broadleaf forest
Acer spp.	Maple	cold deciduous broadleaf forest
Ostrya carpinifolia	Hop-hornbeam	cold deciduous broadleaf forest
Rhamnus sp.	Buckthorn	cold deciduous broadleaf forest
Salicaceae	Willow/Poplar	riparian woodland
Tamarix sp.	Tamarisk	riparian woodland
Celtis sp.	Hackberries	riparian woodland
Ulmus sp.	Elm	riparian woodland
Buxus sempervirens	Boxwood	Possible exotic taxon
Asteraceae-type	Aster family type	woody herbs and small shrubs
Euphorbia sp.	Spurges	woody herbs and small shrubs
Chenopodiaceae	Goosefoot family	woody herbs and small shrubs
Monocotyledonae	Monocots	woody herbs and small shrubs
Cf *Ficus carica*	Common fig (tentative)	Economic (edible products)
Fraxinus angustifolia /ornus	Narrow-leaved or manna ash	Economic (edible products)
Elaeagnus angustifolia	Russian olive	Economic (edible products)
Juglans regia	Walnut	Economic (edible products)
Morus sp.	Mulberry	Economic (edible products)
Maloideae	Apple subfamily	Economic (edible products)
Pistacia sp.	Pistachio	Economic (edible products)
Amygdalus -type	Almond type	Economic (edible products)
Prunus -type	Plums type	Economic (edible products)
Vitis vinifera	Grapevine	Economic (edible products)

Table 5.2 – *List of the anthracological taxa identified at Kınık Höyük, English common names, and analytical group. Information on identification criteria, phytogeographic assumptions, and candidate species in the Anatolian flora are provided in* Appendix 4.

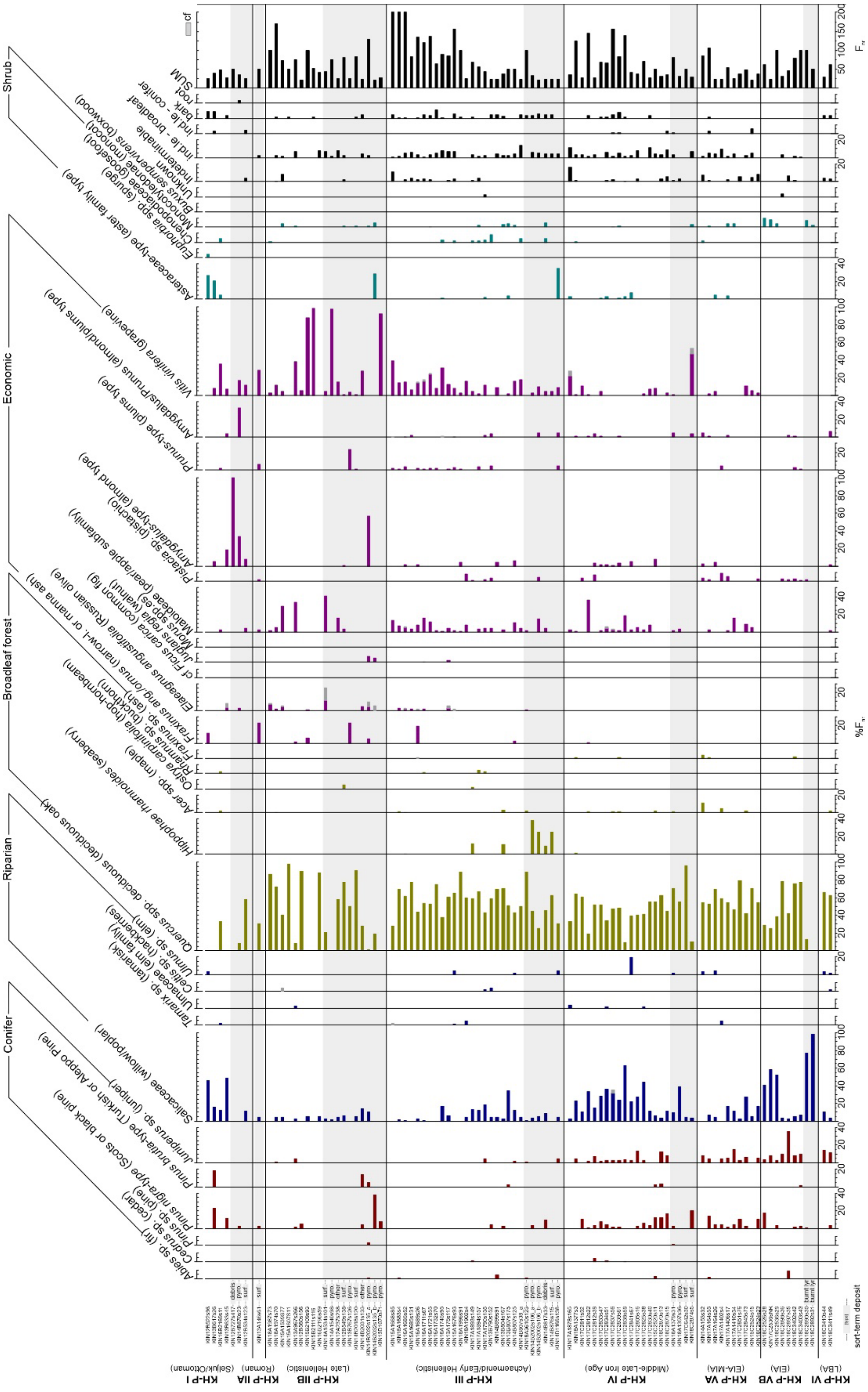
(Next page) Table 5.3 – *Absolute count* (A_{long}), *relative percentage abundance* ($\%l_{ong}$), *absolute ubiquity* (U_{long}), *and percentage ubiquity score* ($U\%_{long}$) *for long-term deposit samples (secondary refuse) grouped by occupation periods (see* Section 3.4.3*). Sample-by-sample results are available in Appendix 4.*

	KH-P I				KH-P IIB			
	Seljuk/Early Ottoman				Late Hellenistic			
Taxon (English name)	A_{long}	$A\%_{long}$	U_{long}	$U\%_{long}$	A_{long}	$A\%_{long}$	U_{long}	$U\%_{long}$
Conifers								
Abies sp. (fir)	—	—	—	—	P	P	P	P
Cedrus sp. (cedar)	—	—	—	—	—	—	—	—
Pinus sp. (pine)	—	—	—	—	P	P	P	P
Pinus nigra -type (Scots or black pine)	19	6.48	6	35.29	3	0.40	3	14.29
Pinus brutia -type (Turkish or Aleppo pine)	7	2.39	1	5.88	5	0.66	3	14.29
Juniperus sp. (juniper)	—	—	—	—	5	0.66	2	9.52
Riparian vegetation								
Salicaceae (willow family)	56	19.11	13	76.47	29	3.84	11	52.38
cf Salicaceae (cf willow family)	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	1	0.34	1	5.88	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	—	—	—	—	2	0.26	1	4.76
Celtis sp. (hackberries)	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	—	—	—	—	3	0.40	1	4.76
Ulmus sp. (elm)	1	0.34	1	5.88	2	0.26	2	9.52
Deciduous forest-scrub								
Quercus spp. deciduous (deciduous oaks)	68	23.21	10	58.82	385	50.99	18	85.71
Hippophae rhamnoides (seaberry)	—	—	—	—	—	—	—	—
Acer spp. (maple)	2	0.68	2	11.76	1	0.13	1	4.76
Ostrya carpinifolia (hop-hornbeam)	—	—	—	—	P	P	P	P
Rhamnus sp. (buckthorn)	1	0.34	1	5.88	—	—	—	—
Fraxinus sp. (ash)	1	0.34	1	5.88	—	—	—	—
cf *Fraxinus* sp. (cf ash)	—	—	—	—	—	—	—	—
Economic trees								
Fraxinus angust. /ornus (narrow-l. or manna ash)	3	1.02	1	5.88	7	0.93	2	9.52
Elaeagnus angustifolia (Russian olive)	12	4.10	7	41.18	18	2.38	7	33.33
cf *Elaeagnus angustifolia (cf Russian olive)*	1	0.34	1	5.88	2	0.26	2	9.52
cf *Ficus carica* (cf common fig)	—	—	—	—	—	—	—	—
Juglans regia (walnut)	1	0.34	1	5.88	P	P	P	P
Morus sp. (mulberry)	5	1.71	2	11.76	—	—	—	—
Maloideae (apple subfamily)	10	3.41	5	29.41	56	7.42	4	19.05
cf Maloideae (cf apple subfamily)	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	P	P	P	P	—	—	—	—
Amygdalus -type (almond type)	16	5.46	6	35.29	P	P	P	P
Prunus -type (plums type)	1	0.34	1	5.88	P	P	P	P
Amygdalus /Prunus (almond/plums type)	6	2.05	5	29.41	1	0.13	1	4.76
cf *Prunus* -type (cf plums genus)	2	0.68	2	11.76	—	—	—	—
Vitis vinifera (grapevine)	37	12.63	10	58.82	197	26.09	10	47.62
cf *Vitis vinifera (cf grapevine)*	—	—	—	—	—	—	—	—
Shrubs								
Asteraceae-type (Aster family type)	22	7.51	6	35.29	P	P	P	P
Euphorbia sp. (spurges)	1	0.34	1	5.88	—	—	—	—
Chenopodiaceae (goosefoot family)	4	1.37	3	17.65	1	0.13	1	4.76
Monocotyledonae (monocots)	1	0.34	1	5.88	9	1.19	5	23.81
Exotic taxa						—		
Buxus sempervirens (boxwood)	—	—	—	—	—	—	—	—
Indeterminable charcoals								
Unknown taxa	—	—	—	—	—	—	—	—
Indeterminable	1	0.34	1	5.88	7	0.93	2	9.52
Indeterminable broadleaf	7	2.39	7	41.18	16	2.12	6	28.57
Indeterminable conifer	1	0.34	1	5.88	—	—	—	—
root broadleaf	P	P	P	P	—	—	—	—
bark	6	2.05	3	17.65	6	0.79	4	19.05
Sums	293		17		755		21*	

	KH-P III				KH-P IV			
	Achaemenid/Hellenistic				Neo Hittite and LIA I			
Taxon (English name)	A_{long}	$A\%_{long}$	U_{long}	$U\%_{long}$	A_{long}	$A\%_{long}$	U_{long}	$U\%_{long}$
Conifers								
Abies sp. (fir)	2	0.10	2	6.25	1	0.08	1	4.00
Cedrus sp. (cedar)	1	0.05	1	3.13	3	0.24	3	12.00
Pinus sp. (pine)	—	—	—	—	P	P	P	P
Pinus nigra -type (Scots or black pine)	3	0.15	3	9.38	43	3.47	14	56.00
Pinus brutia -type (Turkish or Aleppo pine)	1	0.05	1	3.13	2	0.16	2	8.00
Juniperus sp. (juniper)	4	0.19	3	9.38	43	3.47	16	64.00
Riparian vegetation								
Salicaceae (willow family)	88	4.28	20	62.50	354	28.55	19	76.00
cf Salicaceae (cf willow family)	—	—	—	—	5	0.40	1	4.00
Tamarix sp. (tamarisk)	2	0.10	2	6.25	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	4	0.19	1	3.13	—	—	—	—
Ulmaceae (elm family)	—	—	—	—	3	0.24	3	12.00
Celtis sp. (hackberries)	2	0.10	2	6.25	—	—	—	—
cf *Celtis* sp. (cf hackberries)	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	8	0.39	2	6.25	8	0.65	1	4.00
Deciduous forest-scrub								
Quercus spp. deciduous (deciduous oaks)	1162	56.52	32	100.00	510	41.13	25	100.00
Hippophae rhamnoides (seaberry)	15	0.73	4	12.50	2	0.16	1	4.00
Acer spp. (maple)	5	0.24	3	9.38	4	0.32	4	16.00
Ostrya carpinifolia (hop-hornbeam)	1	0.05	1	3.13	—	—	—	—
Rhamnus sp. (buckthorn)	4	0.19	3	9.38	—	—	—	—
Fraxinus sp. (ash)	—	—	—	—	2	0.16	2	8.00
cf *Fraxinus* sp. (cf ash)	1	0.05	1	3.13	—	—	—	—
Economic trees								
Fraxinus angust. /ornus (narrow-l. or manna ash)	27	1.31	2	6.25	1	0.08	1	4.00
Elaeagnus angustifolia (Russian olive)	14	0.68	6	18.75	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	7	0.34	4	12.50	—	—	—	—
cf *Ficus carica* (cf common fig)	1	0.05	1	3.13	—	—	—	—
Juglans regia (walnut)	3	0.15	2	6.25	—	—	—	—
Morus sp. (mulberry)	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	123	5.98	21	65.63	103	8.31	13	52.00
cf Maloideae (cf apple subfamily)	1	0.05	1	3.13	2	0.16	2	8.00
Pistacia sp. (pistachio)	5	0.24	4	12.50	3	0.24	2	8.00
Amygdalus -type (almond type)	14	0.68	5	15.63	14	1.13	7	28.00
Prunus -type (plums type)	29	1.41	12	37.50	—	—	—	—
Amygdalus /Prunus (almond/plums type)	6	0.29	5	15.63	7	0.56	6	24.00
cf *Prunus* -type (cf plums genus)	2	0.10	2	6.25	—	—	—	—
Vitis vinifera (grapevine)	322	15.66	25	78.13	27	2.18	11	44.00
cf *Vitis vinifera (cf grapevine)*	4	0.19	3	9.38	2	0.16	1	4.00
Shrubs								
Asteraceae-type (Aster family type)	4	0.19	3	9.38	12	0.97	6	24.00
Euphorbia sp. (spurges)	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	12	0.58	9	28.13	2	0.16	2	8.00
Monocotyledonae (monocots)	8	0.39	6	18.75	2	0.16	2	8.00
Exotic taxa								
Buxus sempervirens (boxwood)	P	P	P	P	—	—	—	—
Indeterminable charcoals								
Unknown taxa	1	0.05	1	3.13	—	—	—	—
Indeterminable	48	2.33	11	34.38	16	1.29	8	32.00
Indeterminable broadleaf	75	3.65	23	71.88	43	3.47	17	68.00
Indeterminable conifer	—	—	—	—	3	0.24	3	12.00
root broadleaf	—	—	—	—	—	—	—	—
bark	47	2.29	18	56.25	23	1.85	7	28.00
Sums	2056		32*		1240		25	

	KH-P VA				KH-P VB			
	Post Hittite (EIA and MIA I)				Post Hittite (EIA)			
Taxon (English name)	A_{long}	$A\%_{long}$	U_{long}	$U\%_{long}$	A_{long}	$A\%_{long}$	U_{long}	$U\%_{long}$
Conifers								
Abies sp. (fir)	2	0.44	1	10.00	4	0.91	1	14.29
Cedrus sp. (cedar)	—	—	—	—	—	—	—	—
Pinus sp. (pine)	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	28	6.11	8	80.00	17	3.85	4	57.14
Pinus brutia -type (Turkish or Aleppo pine)	—	—	—	—	1	0.23	1	14.29
Juniperus sp. (juniper)	26	5.68	8	80.00	42	9.52	7	100.00
Riparian vegetation								
Salicaceae (willow family)	41	8.95	8	80.00	104	23.58	7	100.00
cf Salicaceae (cf willow family)	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	1	0.22	1	10.00	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	4	0.87	2	20.00	—	—	—	—
Deciduous forest-scrub								
Quercus spp. deciduous (deciduous oaks)	256	55.90	10	100.00	242	54.88	7	100.00
Hippophae rhamnoides (seaberry)	—	—	—	—	—	—	—	—
Acer spp. (maple)	11	2.40	3	30.00	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	4	0.87	2	20.00	1	0.23	1	14.29
cf *Fraxinus* sp. (cf ash)	—	—	—	—	—	—	—	—
Economic trees								
Fraxinus angust. /ornus (narrow-l. or manna ash)	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	—	—	—	—	—	—	—	—
Juglans regia (walnut)	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	13	2.84	5	50.00	—	—	—	—
cf Maloideae (cf apple subfamily)	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	11	2.40	5	50.00	5	1.13	4	57.14
Amygdalus -type (almond type)	3	0.66	2	20.00	—	—	—	—
Prunus -type (plums type)	1	0.22	1	10.00	3	0.68	2	28.57
Amygdalus /Prunus (almond/plums type)	6	1.31	3	30.00	2	0.45	2	28.57
cf *Prunus* -type (cf plums genus)	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	10	2.18	5	50.00	—	—	—	—
cf *Vitis vinifera (cf grapevine)*	—	—	—	—	—	—	—	—
Shrubs								
Asteraceae-type (Aster family type)	3	0.66	2	20.00	—	—	—	—
Euphorbia sp. (spurges)	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	1	0.22	1	10.00	—	—	—	—
Monocotyledonae (monocots)	4	0.87	3	30.00	12	2.72	3	42.86
Exotic taxa								
Buxus sempervirens (boxwood)	—	—	—	—	—	—	—	—
Indeterminable charcoals								
Unknown taxa	—	—	—	—	1	0.23	1	14.29
Indeterminable	14	3.06	6	60.00	4	0.91	2	28.57
Indeterminable broadleaf	13	2.84	8	80.00	3	0.68	3	42.86
Indeterminable conifer	4	0.87	2	20.00	—	—	—	—
root broadleaf	—	—	—	—	—	—	—	—
bark	2	0.44	1	10.00	—	—	—	—
Sums	458		10		441		7	

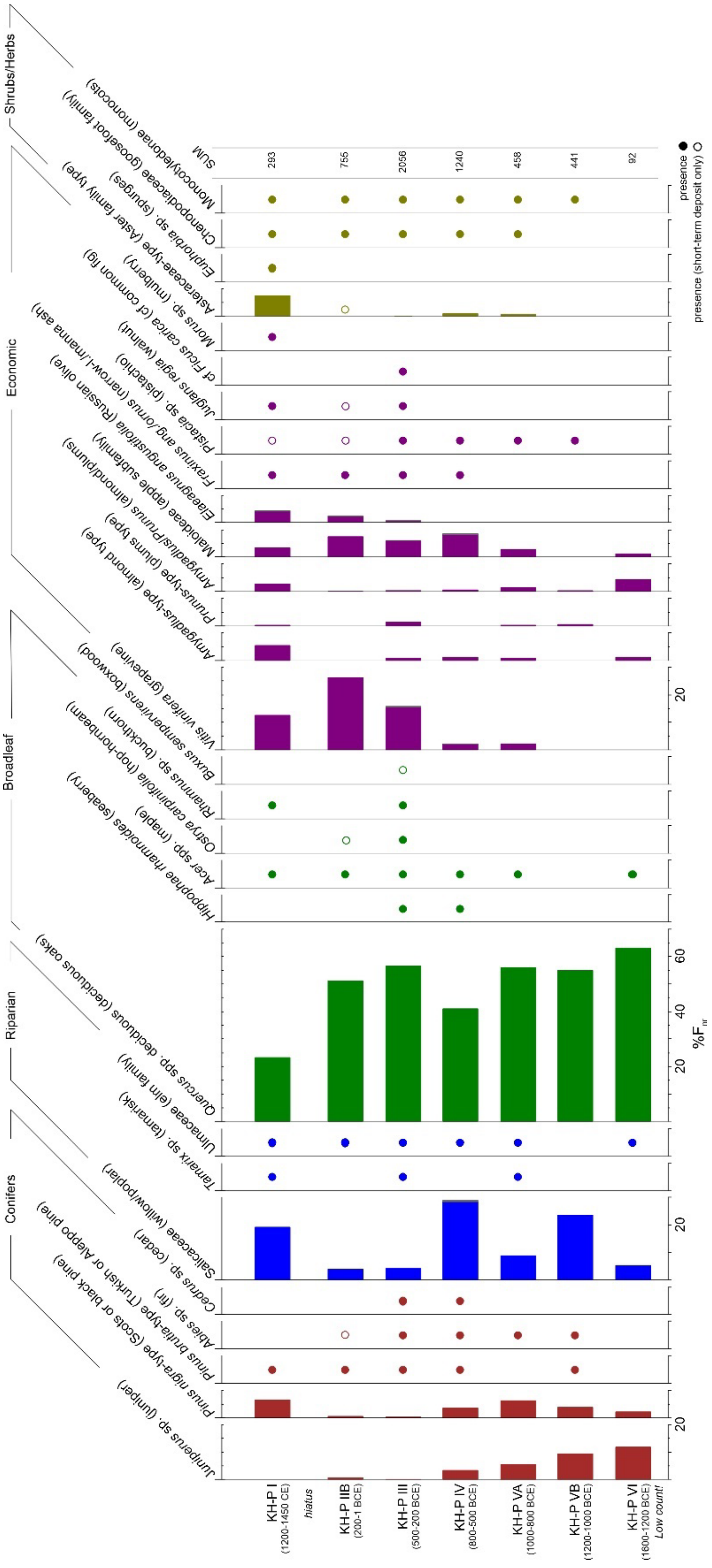
	KH-P VI			
	Late Bronze Age			
Taxon (English name)	A_{long}	$A\%_{long}$	U_{long}	$U\%_{long}$
Conifers				
Abies sp. (fir)	—	—	—	—
Cedrus sp. (cedar)	—	—	—	—
Pinus sp. (pine)	—	—	—	—
Pinus nigra -type (Scots or black pine)	2	2.17	1	50.00
Pinus brutia -type (Turkish or Aleppo pine)	—	—	—	—
Juniperus sp. (juniper)	11	11.96	2	100.00
Riparian vegetation				
Salicaceae (willow family)	5	5.43	2	100.00
cf Salicaceae (cf willow family)	—	—	—	—
Tamarix sp. (tamarisk)	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	—	—	—	—
Ulmaceae (elm family)	—	—	—	—
Celtis sp. (hackberries)	1	1.09	1	50.00
cf *Celtis* sp. (cf hackberries)	—	—	—	—
Ulmus sp. (elm)	2	2.17	2	100.00
Deciduous forest-scrub				
Quercus spp. deciduous (deciduous oaks)	58	63.04	2	100.00
Hippophae rhamnoides (seaberry)	—	—	—	—
Acer spp. (maple)	1	1.09	1	50.00
Ostrya carpinifolia (hop-hornbeam)	—	—	—	—
Rhamnus sp. (buckthorn)	—	—	—	—
Fraxinus sp. (ash)	—	—	—	—
cf *Fraxinus* sp. (cf ash)	—	—	—	—
Economic trees				
Fraxinus angust. /ornus (narrow-l. or manna ash)	—	—	—	—
Elaeagnus angustifolia (Russian olive)	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	—	—	—	—
cf *Ficus carica* (cf common fig)	—	—	—	—
Juglans regia (walnut)	—	—	—	—
Morus sp. (mulberry)	—	—	—	—
Maloideae (apple subfamily)	1	1.09	1	50.00
cf Maloideae (cf apple subfamily)	—	—	—	—
Pistacia sp. (pistachio)	—	—	—	—
Amygdalus -type (almond type)	1	1.09	1	50.00
Prunus -type (plums type)	—	—	—	—
Amygdalus /Prunus (almond/plums type)	4	4.35	1	50.00
cf *Prunus* -type (cf plums genus)	—	—	—	—
Vitis vinifera (grapevine)	—	—	—	—
cf *Vitis vinifera (cf grapevine)*	—	—	—	—
Shrubs				
Asteraceae-type (Aster family type)	—	—	—	—
Euphorbia sp. (spurges)	—	—	—	—
Chenopodiaceae (goosefoot family)	—	—	—	—
Monocotyledonae (monocots)	—	—	—	—
Exotic taxa			—	—
Buxus sempervirens (boxwood)	—	—	—	—
Indeterminable charcoals				
Unknown taxa	—	—	—	—
Indeterminable	3	3.26	2	100.00
Indeterminable broadleaf	—	—	—	—
Indeterminable conifer	—	—	—	—
root broadleaf	—	—	—	—
bark	3	3.26	2	100.00
Sums	92		2	



Conifer
Riparian
Broadleaf forest
Economic
Shrub
Abies sp. (fir)
Cedrus sp. (cedar)
Pinus sp. (pine)
Pinus nigra-type (Scots or black pine)
Pinus brutia-type (Turkish or Aleppo Pine)
Juniperus sp. (juniper)
Salicaceae (willow/poplar)
Tamarix sp. (tamarisk)
Ulmaceae (elm family)
Celtis sp. (hackberries)
Ulmus sp. (elm)
Quercus spp. deciduous (deciduous oak)
Hippophae rhamnoides (seaberry)
Acer spp. (maple)
Ostrya carpinifolia (hop-hornbeam)
Rhamnus sp. (buckthorn)
Fraxinus sp. (ash)
Fraxinus ang-ornus (narrow-l. or manna ash)
Elaeagnus angustifolia (Russian olive)
cf Ficus carica (common fig)
Juglans regia (walnut)
Morus spp. es
Maloideae (pear/apple subfamily)
Pistacia sp. (pistachio)
Amygdalus-type (almond type)
Prunus-type (plums type)
Amygdalus/Prunus (almond/plums type)
Vitis vinifera (grapevine)
Asteraceae-type (aster family type)
Euphorbia sp. (spurge)
Chenopodiaceae (goosefoot)
Monocotyledon (monocot)
Buxus sempervirens (boxwood)
Unknown
Indeterminable
Ind.le - broadleaf
bark - conifer
root
SUM
cf
%F$_w$
F$_w$
KH-P I (Seljuk/Ottoman)
KH-P IIA (Roman)
KH-P IIB (Late Hellenistic)
KH-P III (Achaemenid/Early Hellenistic)
KH-P IV (Middle-Late Iron Age)
KH-P VA (EIA-MIA)
KH-P VB (EIA)
KH-P VI (LBA)
sort-term deposit

(Previous page) Figure 5.6 – *Plot of the anthracological results. Only samples with more than 20 charcoal fragments analyzed are represented. The graph is based on relative abundances (%), calculated on the basis of fragment counts and including in the sum indeterminate fragments. Samples from short-term and long-term deposits are distinguished, the former are represented at the beginning of each occupation period on a grey background. Within each period samples are ordered according to operation and secondarily to their stratigraphic position. The following taxa are attested exclusively in samples with less than 20 fragments analyzed:* Buxus *sp. (KH-P III), cf.* Ficus carica *(KH-P III), and Morus sp. (KH-P I).*

(Next page) Figure 5.7 – *Anthracological results of samples from long-term deposits (secondary refuse) grouped for occupation periods. Relative abundances are calculated for each occupation period on the basis of the fragment counts (indeterminate fragments included in sum). Minor and secondary taxa are represented only as presence/absence.*


Conifers
Riparian
Broadleaf
Economic
Shrubs/Herbs
Juniperus sp. (juniper)
Pinus nigra-type (Scots or black pine)
Pinus brutia-type (Turkish or Aleppo pine)
Abies sp. (fir)
Cedrus sp. (cedar)
Salicaceae (willow/poplar)
Tamarix sp. (tamarisk)
Ulmaceae (elm family)
Quercus spp. deciduous (deciduous oaks)
Hippophae rhamnoides (seaberry)
Acer spp. (maple)
Ostrya carpinifolia (hop-hornbeam)
Rhamnus sp. (buckthorn)
Buxus sempervirens (boxwood)
Vitis vinifera (grapevine)
Amygdalus-type (almond type)
Prunus-type (plums type)
Amygdalus/Prunus (almond/plums)
Maloideae (apple subfamily)
Elaeagnus angustifolia (Russian olive)
Fraxinus ang./ornus (narrow-l./manna ash)
Pistacia sp. (pistachio)
Juglans regia (walnut)
cf Ficus carica (cf common fig)
Morus sp. (mulberry)
Asteraceae-type (Aster family type)
Euphorbia sp. (spurges)
Chenopodiaceae (goosefoot family)
Monocotyledonae (monocots)
SUM
293
755
2056
1240
458
441
92
KH-P I (1200-1450 CE)
hiatus
KH-P IIB (200-1 BCE)
KH-P III (500-200 BCE)
KH-P IV (800-500 BCE)
KH-P VA (1000-800 BCE)
KH-P VB (1200-1000 BCE)
KH-P VI (1600-1200 BCE)
Low count!
20
20
20
40
60
20
$\%F_{rir}$
presence ●
presence (short-term deposit only) ○

– *Period KH-P VI (Late Bronze Age; ca. 1600 – 1200 BCE)*

Only two samples are available for this occupation period (total 92 charcoal fragments), originating from two accumulations (C3410 and C3411) reached at the bottom of a deep trench in Operation C, Sector C3. The attribution of these samples to the Late Bronze Age is corroborated by radiocarbon dating of a cereal grain extracted from sample KIN18C3411s49.[27]

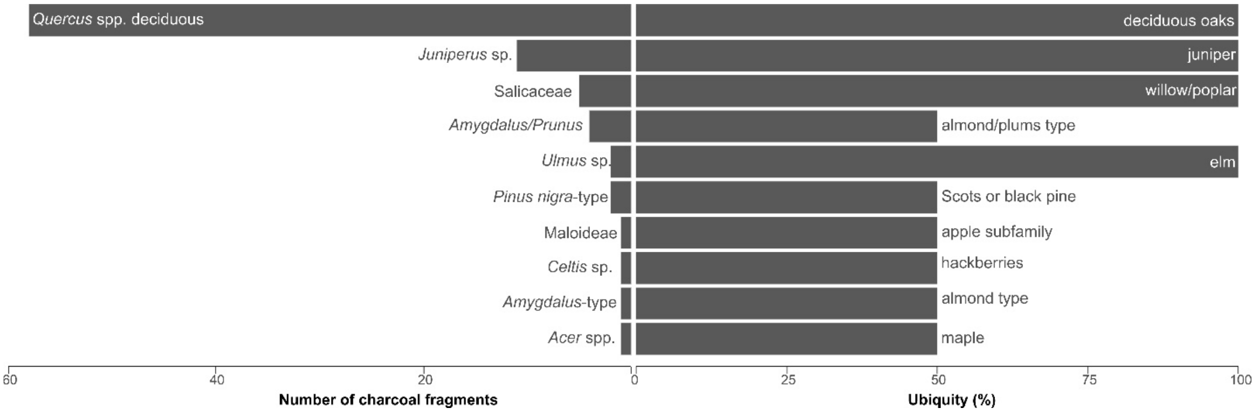


Figure 5.8 – *On the left, plot of charcoal counts (number of charcoal fragments attributed to a taxon); on the right, taxon ubiquity (percentage of samples in which a taxon is found). The figure is based on KH-P VI (1600-1200 BCE) samples from long-term deposits. On the left is reported the scientific name of the taxa, on the right their English common name.*

A low floristic diversity was detected (9 taxa identified), likely resulting from the low number of samples available and the low fragment count (Figure 5.8). *Quercus* spp. deciduous (deciduous oaks) is the dominant taxon (abundance 63%, calculated on the basis of fragment counts), followed by *Juniperus* sp. (juniper; 12%) and Salicaceae (willow/poplar; 5%). Other taxa are only sporadically attested: *Pinus nigra*-Type (Scots or black pine; 2 fragments), *Celtis* sp. (hackberry; 1 fragment), *Ulmus* sp. (elm; 2 fragments), *Acer* sp. (maple; 1 fragment), maloideae (apple subfamily; 1 fragment), and *Amygdalus*-Type (almond type; 1 fragment).[28]

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[27] TUBITAK-0394, 3017 ± 29 uncal BP, 1259.5 ± 130.5 cal BCE (95.4% probability). Calibration obtained in OxCal v4.4.3 (Bronk Ramsey 2017) using the IntCal20 atmospheric calibration curve (Reimer et al. 2020).

– *Period KH-P VB* (*Early Iron Age; ca. 1200 – 1000 BCE*)

Seven samples from long-term deposits are available for this period. Samples were collected from accumulations stratigraphically earlier than the Iron Age citadel walls, exposed in Operation C, Sector C3 (Section 3.4.3). The chronology of these deposits is confirmed by a sequence of radiocarbon determinations (Table 3.2).

A total of 441 charcoal fragments from samples taken from long-term deposits were analyzed, leading to the identification of 11 taxa (Figure 5.9). *Quercus* spp. deciduous (deciduous oaks) remains the dominant taxon in the assemblage (abundance 55%, ubiquity 100%), followed by Salicaceae (willow/poplar; a. 24%, u. 100%) and *Juniperus* sp. (juniper; a. 10%, u. 100%). In addition to Juniper, other conifers attested are *Pinus nigra*-Type (black or Scots pines; a. 4%, u. 57%), and single charcoal fragments of *Pinus brutia*-Type (Turkish or Aleppo pine; 1 fragment) and *Abies* sp. (fir, 4 charcoal fragments from a single sample). Among broadleaf, other minor taxa identified are *Fraxinus* sp. (1 fragment), *Pistacia* sp. (5 fragments, 4 samples), *Prunus*-Type (3 fragments, 2 samples), and *Prunus*/*Amygdalus* (2 fragments, 2 samples). It should be finally noted that monocot charcoals (12 fragments, originating from 3 samples) were comparatively abundant.

Two samples from short-term deposits were analyzed. Both samples originated from in-situ burning events detected in Sector C3: fire layer C2890 (KIN18C2890s30) and C2892=C2543 (KIN18C2892s31). Sample KIN18C2890s30 is dominated by willow/poplar (Salicaceae) charcoal (77%); followed by deciduous oaks (*Quercus* sp. deciduous; 13%), monocots (7%), Pistachio (*Pistacia* sp.; 2 fragments), and black/Scots pine (*Pinus nigra*-Type; 1 fragment). Sample KIN18C2892s31 is almost entirely composed by willow/poplar (Salicaceae) charcoal (98%), and single fragments of monocots stems.

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[28] *Prunus*-Type and *Amygdalus*-Type refer to two distinct anthracological sections within the genus *Prunus* spp. For the description of anthracological types and a list of candidate taxa in the Turkish flora, I refer you to Appendix 4.

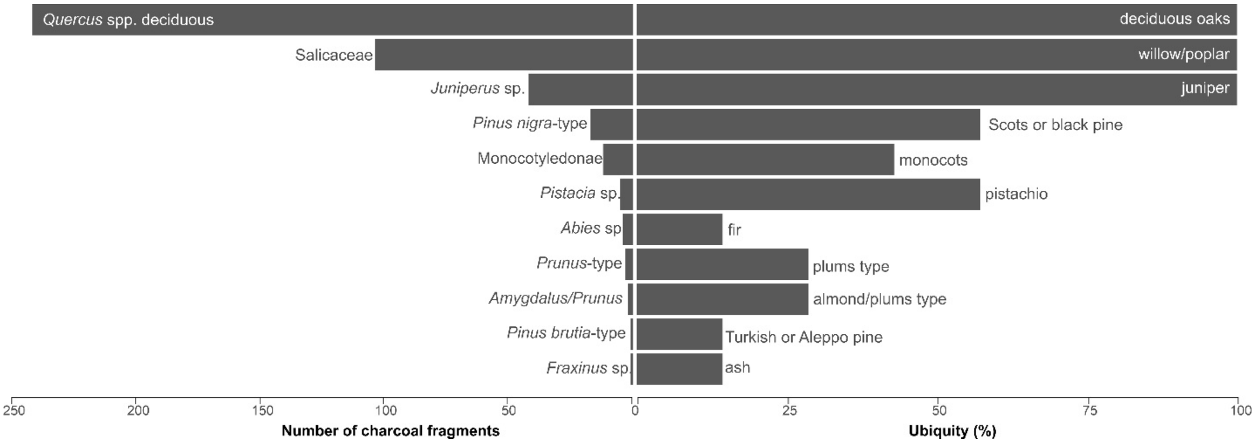

Figure 5.9 – *On the left, plot of charcoal counts (number of charcoal fragments attributed to a taxon); on the right, taxon ubiquity (percentage of samples in which a taxon is found). The figure is based on KH-P VB (1200-1000 BCE) samples from long-term deposits. On the left is reported the scientific name of the taxa, on the right their English common name.*

– *Period KH-P VA (Early-Middle Iron Age; ca. 1000 – 800 BCE)*

Ten samples from long-term deposits are available for period KH-P VA. Samples were collected from Operation C and Operation A (Section 3.4.3). In Operation C, samples attributed to this occupation period originated from deposits associated to the earthen rampart C2673 (2 samples) and from accumulations in between use phases of the Iron Age granaries (Chapter 4) located to the inside of the walls (2 samples). In Operation A, KH-P A samples were collected from accumulations abutting the outer façade of the Iron Age citadel walls in Operation A, Sector Aw (6 samples) (Section 3.4.3).

A total of 458 charcoal fragments were analyzed, leading to the identification of 17 taxa (Figure 5.10). Deciduous oaks (*Quercus* spp. deciduous) remains the dominant taxon (abundance 56%, ubiquity 100%). Both Salicaceae (willow/poplar; a. 9% u. 80%) and *Juniperus* sp. (juniper; a. 6%, u. 80%) are attested in significant quantities, although lower than during KH-P VB. Black/Scots pine (*Pinus nigra*-Type) is comparatively frequently attested (a. 6% u. 80%). Maloideae (apple subfamily; a. 3%, u. 50%) and Pistachio (*Pistacia* sp. a. 2% u. 50%) charcoal fragments are attested in lower quantities, yet with a significant ubiquity.

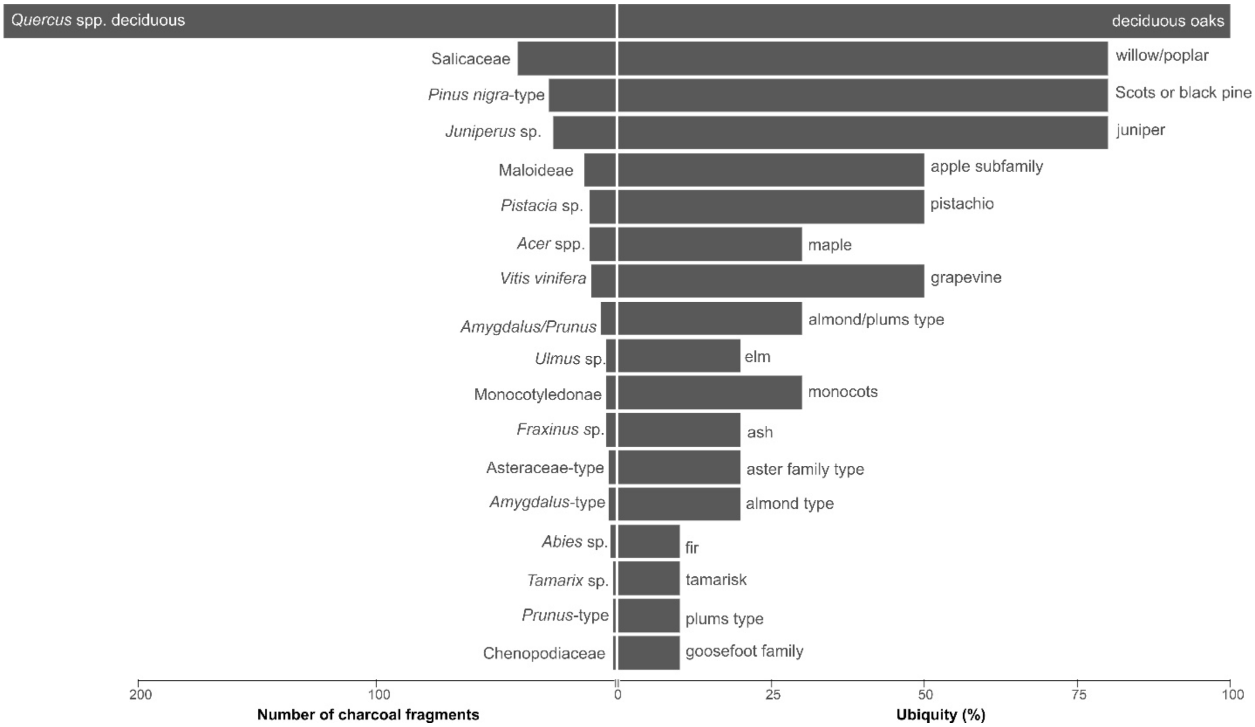

Figure 5.10 – *On the left, plot of charcoal counts (number of charcoal fragments attributed to a taxon); on the right, taxon ubiquity (percentage of samples in which a taxon is found). The figure is based on KH-P VA (1000-800 BCE) samples from long-term deposits. On the left is reported the scientific name of the taxa, on the right their English common name*

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During period HP-P VA, grapevine (*Vitis vinifera*) charcoal is attested for the first-time. Grapevine charcoal fragments are found relatively ubiquitous (50% of samples), yet in low counts (total 10 fragments). Minor taxa attested during KH-P VA are fir (*Abies* sp.; 2 fragments), Tamarisk (*Tamarix* sp.; 1 fragment); elm (*Ulmus* sp. 4 fragments), maple (*Acer* sp.; 11), ash (*Fraxinus* sp. 4 fragments), Almond type (*Amygdalus*-Type; 3, fragments), plums type (*Prunus*-Type; 1 fragment)[29]; Aster family type (Asteraceae-Type; 3 fragments), goosefoot family (Chenopodiaceae s.l.; 1 fragments), and monocots (Monocotyledoneae s.l.; 4 fragments).

– *Period KH-P IV* (*Middle-Late Iron Age; ca. 800 – 500 BCE*)

25 samples from long-term deposits were analyzed. Samples originate from Operation A (Sector A1, 1 sample; Sector A2, 4 samples) and Operation C, Sector C3 (20 samples). A total of 1240 charcoal fragments have been analyzed (Figure 5.11). The floristic diversity is stable (18 taxa). As in the previous phases, *Quercus* spp. deciduous (deciduous oaks) is predominant, although with a slightly decrease in abundance (a. 41%, u. 100%), followed by Salicaceae (willow/poplar; a. 28%, u. 76%). Conifers drop in abundance, mostly represented by *Juniperus* sp. (junipers; a. 3%, u. 64%) and *Pinus nigra*-Type (black/Scots pine; a. 3%, u. 56%). *Pinus brutia*-Type (Aleppo/Turkish pine; 2 fragments, from 2 samples), *Abies* sp. (fir; 1 fragment), and *Cedrus* sp. (cedar; 3 fragments, from 3 samples) are only sporadically attested. *Vitis vinifera* increases both in terms of abundance and ubiquity (a. 2%, u. 44%), as does Maloideae (a. 8%, u. 52%). Among minor taxa we find the first attestation of *Fraxinus angustifolia/ornus* (narrow-leaved/manna ash; 1 fragment) and *Hippophae rhamnoides* (seaberry; 2 fragments).

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[29] 6 additional charcoal fragments are more generically attributed to *Amygdalus/Prunus*. See Appendix 4 for explanations on the distinction between the two types.

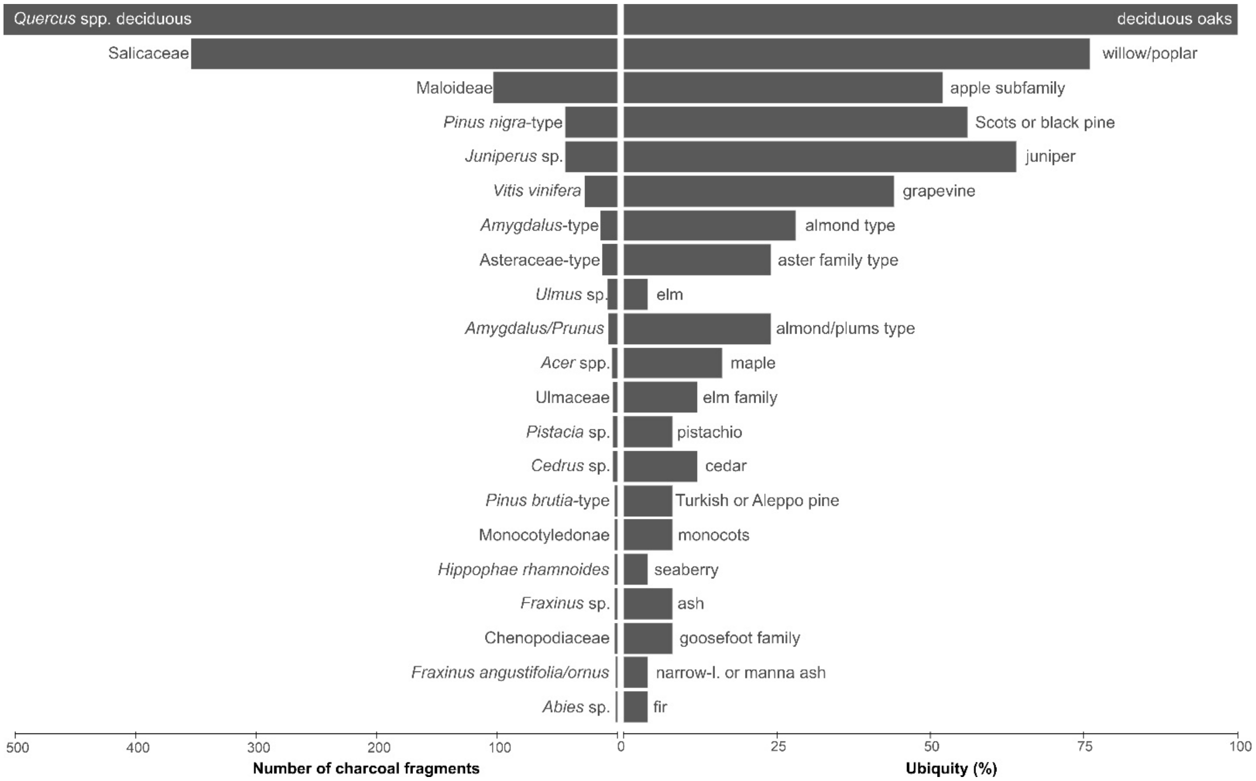


Figure 5.11 – *On the left, plot of charcoal counts (number of charcoal fragments attributed to a taxon); on the right, taxon ubiquity (percentage of samples in which a taxon is found). The figure is based on KH-P IV (800-500 BCE) samples from long-term deposits. On the left is reported the scientific name of the taxa, on the right their English common name.*

– *Period KH-P III (Achaemenid-Early Hellenistic; ca. 500 – 200 BCE)*

From this period, 2056 charcoal fragments from 36 long-term deposit samples were analyzed (Figure 5.12). Samples originated from Operation A (Sector A1, 21 samples; Sector A2, 2 samples), Operation B (8 samples), and Operation D (5 samples). Floristic diversity significantly increases (27 taxa). *Quercus* spp. deciduous (oak deciduous) remains predominant (abundance 57%, ubiquity 100%). A significant drop in frequencies is documented for the Salicaceae family (willow/poplar; a. 4%, u. 62%). Conifers continue a decreasing trend, now being only sporadically attested: *Pinus nigra*-Type (black/Scots pine; 3 fragments, from 3 samples), *Pinus brutia*-Type (Aleppo/Turkish pine; 1 fragment), *Abies* sp. (fir; 2 fragments, from 2 samples), *Cedrus* sp. (cedar; 1 fragment), and *Juniperus* sp. (junipers; 4 fragments, from 3 samples). Remarkable is the rise of grapevine (*Vitis vinifera*), both in terms of abundance and ubiquity (a. 16%, u. 78%), coupled by a generalized increase of other economic taxa. Among these are the first attestations of *Elaeagnus angustifolia* (Russian olive; 14 fragments, from 6 samples) and *Juglans regia* (walnut; 3 fragments, from 2 samples). Among minor taxa, an increase in *Hippophae rhamnoides* charcoal (seaberry; 15 fragments, from 4 samples) and Chenopodiaceae (goosefoot family; 12 fragments, from 9 samples) is noted.

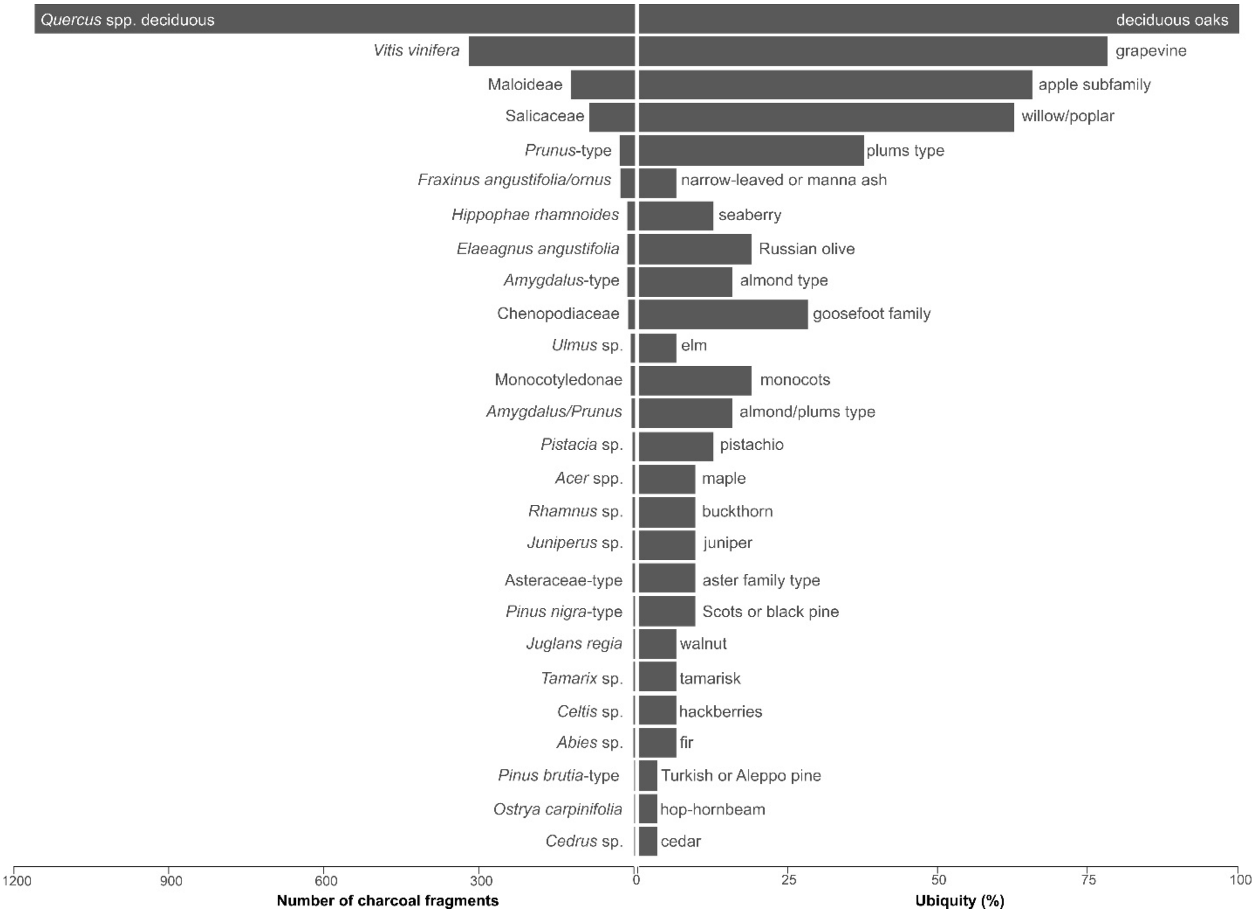


Figure 5.12 – *On the left, plot of charcoal counts (number of charcoal fragments attributed to a taxon); on the right, taxon ubiquity (percentage of samples in which a taxon is found). The figure is based on KH-P III (500-200 BCE) samples from long-term deposits. On the left is reported the scientific name of the taxa, on the right their English common name.*

Twenty additional samples from short-term deposits were analyzed (total 272 charcoal fragments), including pyrotechnic installations (12 samples) and occupation layers (6 samples) (Appendix 3). The samples available from occupation layers (5 samples) and pyrotechnic installations (8 samples) in the domestic building in Operation D are composed almost exclusively of ashes with only a sporadic presence of macroscopic charcoal: only one sample returned more than 10 charcoal fragments in the >4 mm fraction (sample KIN14D1166s138, from the fill of an oven). In this sample, atypical is the abundance of Asteraceae-Type (8 fragments). Short-lived samples from Operation B stand out for comparatively high counts of *Hippophae rhamnoides*.

– *Period KH-P IIB* (*Late Hellenistic; ca. 200 – 1 BCE*)

755 charcoal fragments from 22 samples originating from long-term deposits were analyzed, collected in Operation A (Sector A1, 6 samples; Sector A2, 7 samples), Operation B (7 samples), and Operation D (2 samples).

The wood charcoal record from KH-P IIB is in continuity with the previous period (Figure 5.13). *Quercus* spp. deciduous is the dominant taxon (a. 51%, u. 86%) and Salicaceae remain stable at low values (a. 4%, u. 52%). Conifer charcoal is still poorly attested: *Pinus nigra*-Type (3 fragments, from 3 samples), *Pinus brutia*-Type (5 fragments, from 3 samples), and *Juniperus* sp. (5 fragments, from 2 samples). Economic taxa continue their increasing trend, with *Vitis vinifera* charcoal reaching percentage fragments counts of 26% and a ubiquity score of 48% (Table 5.3). Overall, a higher degree of sample variability is registered, both among and within the different operations.

Eighteen additional samples (648 charcoal fragments) from short-term deposits were analyzed.

To be noted is the presence of *Abies* sp. (KIN14B2032s135_a) and *Juglans regia* (KIN14B2032s135) in these samples, taxa otherwise unattested during this occupation period (Figure 5.6). Samples from fire residues associated with a hearth in Operation A (KIN14A1540s98) and the fill of an oven excavated in Operation D (KIN13D1070s71), are both dominated by *Vitis vinifera* charcoal (respectively 97% and 93%).

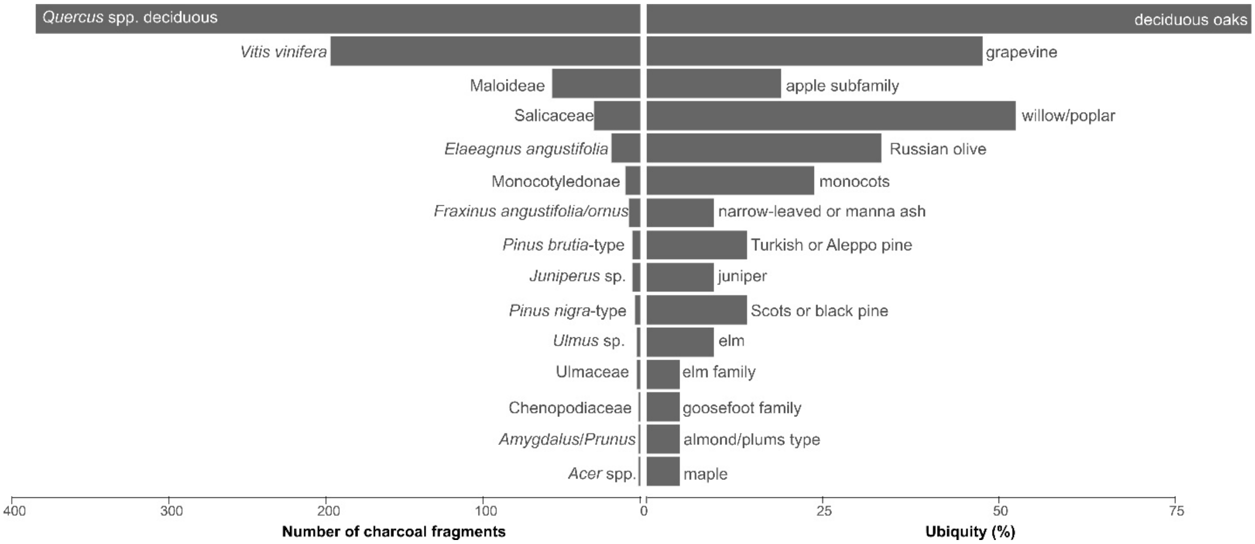


Figure 5.13 – *On the left, plot of charcoal counts (number of charcoal fragments attributed to a taxon); on the right, taxon ubiquity (percentage of samples in which a taxon is found). The figure is based on KH-P IIB (200-1 BCE) samples from long-term deposits. On the left is reported the scientific name of the taxa, on the right their English common name.*

– *Period KH-P IIA (Roman; ca. 1 – 300 CE)*

This occupation period has been only recently identified in Operation A, Sector A1 (Section 3.4.3). Two short-lived samples (KIN13A146s61 and KIN14A131s138), previously (Castellano 2021) attributed to KH-P IIB, were reassigned to this period. KIN13A146s61 originated from an in-situ burning; the samples is characterized by presence of deciduous oak (*Quercus* sp. Deciduous, 15 fragments), narrow-leaved/manna ash (*Fraxinus ornus/angustifolia*, 11 fragments), and grapevine (*Vitis vinifera*, 14 fragments). No macroscopic wood charcoal fragments are found in KIN14A131s138.

– *Period KH-P I (Seljuk-Early Ottoman; ca. 1200 – 1450 CE)*

After a possible hiatus after KH-P IIA, the mound was resettled in the late Medieval period (Section 3.4.3). For this period 293 charcoal fragments from 17 long-term deposit samples were analyzed resulting in 21 taxa identified (Figure 5.14). All samples originated from Operation B.

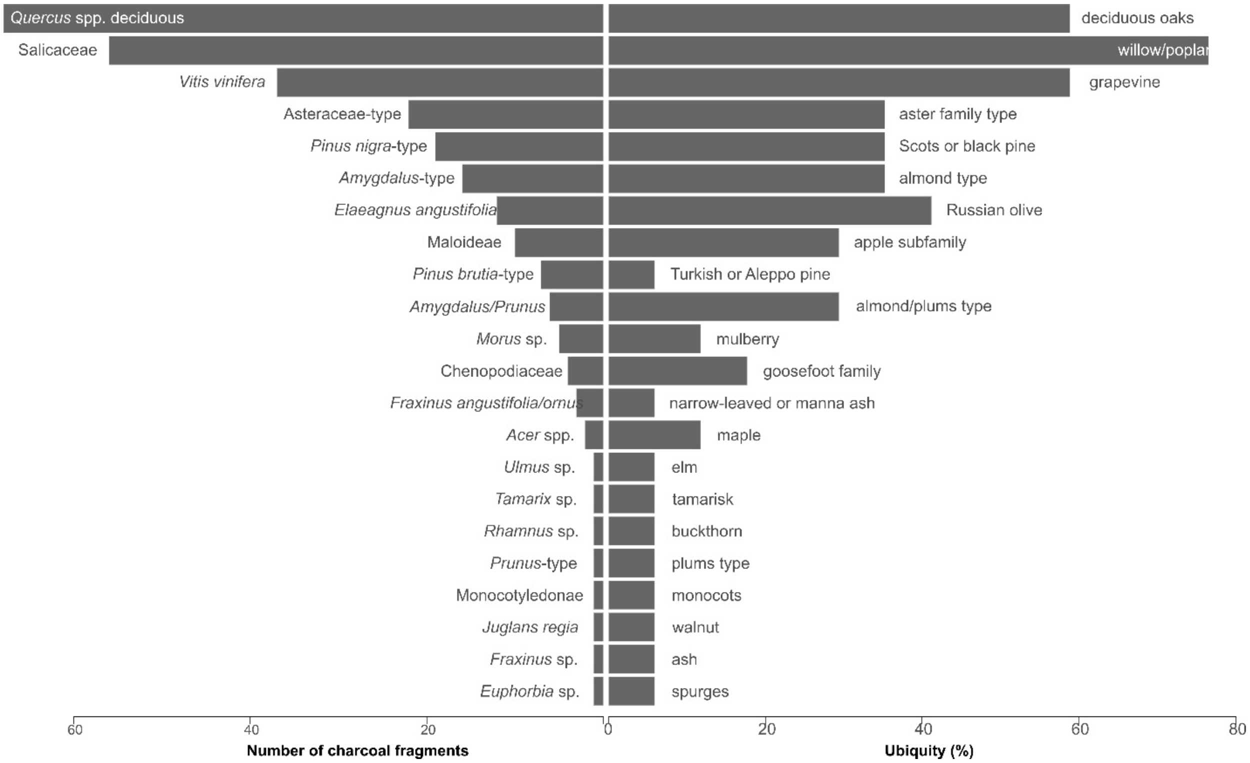


Figure 5.14 – *On the left, plot of charcoal counts (number of charcoal fragments attributed to a taxon); on the right, taxon ubiquity (percentage of samples in which a taxon is found). The figure is based on KH-P I (1200 CE-1450 CE) samples from long-term deposits. On the left is reported the scientific name of the taxa, on the right their English common name.*

Quercus spp. deciduous for the first time experienced a significant drop (a. 23%, u. 59%), while Salicaceae charcoal increased in frequency (a. 19%, u. 76%). *Abies* sp. and *Cedrus* sp. are no longer attested, while an increase is evident for *Pinus nigra*-Type (a. 6%, u. 35%). *Pinus brutia*-Type is only sporadically attested (7 fragments, from a single sample). Economic taxa remain quantitatively important, with *Amygdalus*-Type (almond type) experiencing an increase (a. 6%, u. 35%). *Vitis vinifera* charcoal is still frequently attested (a. 13%, u. 59%), although in lower values than previously. Asteraceae (Aster family) become relatively common (a. 8%, u. 35%).

8 additional samples (151 charcoal fragments) from short-term deposits were analyzed. These samples confirm the increased importance of *Amygdalus*-Type. Also notable is the presence of *Vitis vinifera* charcoal in samples collected from a hearth deposit (sample KIN14B870s23) and from an occupation layer (KIN12B534s123), demonstrating that grapevine charcoal in this level was not redeposited from earlier phases.

5.3.3 *Multivariate analysis*

The multivariate plot (PCA) presented in Figure 5.15 summarizes the main trends in the wood charcoal record from Niğde-Kınık Höyük. Results are presented as a correlation biplot (scaling 2), thus maintaining the angle between descriptor vectors (species) reflecting their correlation, with small angles indicating high positive correlation, opposite angles high negative correlation, and right angles lack of correlation. Right-angled projections of a sample (point) on the vector of a taxon (descriptor) approximates the value of that taxon in the sample.

Samples from the earlier occupation periods (KH-P VI, VB, VA, and IV) cluster in the upper part of the diagram, defined by the presence of *Juniperus*. Their distribution on the PC1 axis mainly reflects the variable contribution of *Quercus*, Salicaceae, and — to a lesser extent – *Pinus*. Samples from the second half of the 1st millennium BCE (KH-P III and II) are characterized by a higher contribution of

Vitis, which is negatively correlated with *Juniperus* and other minor taxa characteristic of the earlier portion of the sampled sequence (e.g., *Acer*, *Abies*, *Cedrus*, and *Pistacia*), and positively correlated with the other main economic taxa, with the sole exception of *Amygdalus*-Type.

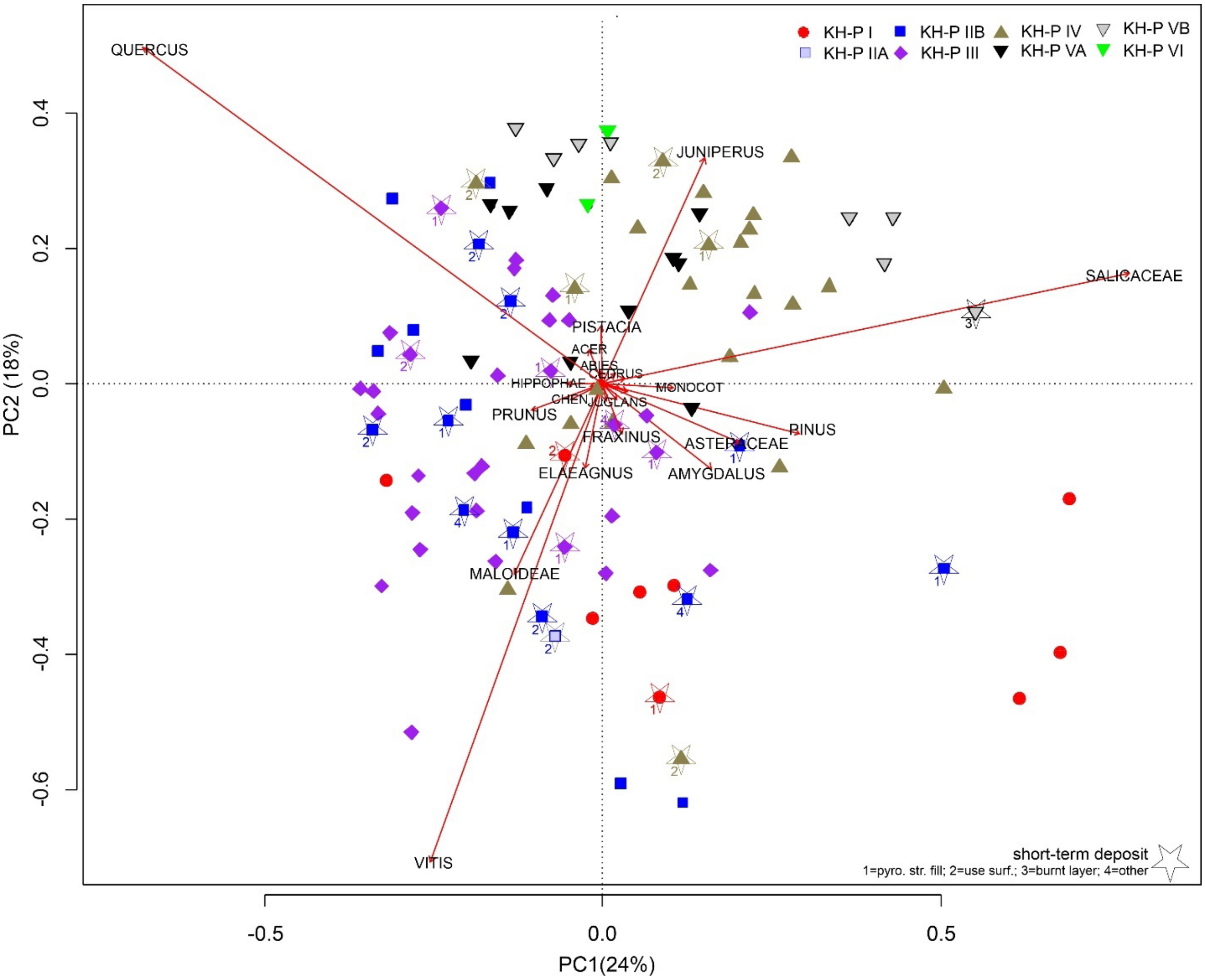


Figure 5.15 – *PCA of the anthracological data from Kınık Höyük. Results are presented as correlation biplot (scaling 2).*

KH-P III and KH-P II samples are mostly located in the portion of the plot defined by negative values of PC1, thus associated with a lower contribution of Salicaceae. A clear distinction between the two periods is not evident, supporting a degree of similarity between these two occupation phases. The Late Medieval (KH-P I) samples are relatively scattered in the plot, mostly located by the PCA in the bottom right quadrant, defined by atypical low values of *Quercus* and a positive contribution of *Amygdalus*-Type, Asteraceae, *Pinus*, and Salicaceae.

In the PCA biplot are included also samples from short-term deposits (Figure 5.15). These assemblages represent a single or few fires, with a composition that is more likely to reflect the specific availability of firewood in that specific moment in time, rather than being representative of the general pattern of firewood exploitation during any occupation period of the site (e.g., Asouti and Austin 2005, Kabukcu and Chabal 2021). In most instances, however, the taxa overrepresented in short-term samples are consistent with the dominant taxa in the specific occupation period (Figure 5.15), confirming observations already made in the literature (e.g., Badal Garcia 1992).

5.4 Discussion: vegetation, arboriculture, and firewood exploitation at Niğde-Kınık Höyük

5.4.1 *General interpretation of the anthracological results*

The wood charcoal assemblage from Niğde-Kınık Höyük is characterized by a remarkably high taxonomic diversity, with 29 identified taxa (Table 5.2), this value is significantly higher than contemporary anthracological sequences from other central Anatolia sites: at Gordion are attested 22 taxa (Marston 2017), including exotic taxa attested exclusively in furniture from the funerary tumuli; while in the intensively studies site of Kaman-Kalehöyük are recorded only 19 taxa (Wright et al. 2015, 2017, Wright 2018). This floristic richness of the Niğde-Kınık Höyük anthracological record might be interpreted as resulting from the presence of a more diverse and fragmented vegetation landscape, which was exploited for firewood purposes. The diachronic changes detected through the sequence (Figure 5.6 and 5.7) might reflect thus phases of expansion and retreat of those vegetation associations

(Asouti and Austin 2005), and/or changes in preferences for the exploitation of some vegetation communities for fuel instead of others. To date, evidence of wood charcoal originating from taxa exotic to central Anatolia is limited to single boxwood (*Buxus* sp.) charcoal (Davis 1982). Accordingly, non-local firewood resources are considered to have played a marginal role (if any) in the observed anthracological record.

Deciduous oaks (*Quercus* sp. deciduous) is the dominant taxon throughout the sampled sequence (Table 5.3, Figure 5.6 and 5.7). As I will discuss in the next section (5.4.2), oaks were very likely present on the slopes of the mountains present to the north of the site (Hasan, Keçiboyduran, and Melendiz; Figure 3.1), where they were intensively exploited for firewood purposes. During the earliest periods of the sampled sequence (KH-P VI, V, IV), conifers (especially junipers and Scots/black pine) and riparian trees (mainly Salicaceae) are frequently attested (Table 5.3, Figure 5.6 and 5.7). Starting with period KH-P VA, it is documented a steady increase in the relative abundance of economic tree, defined as accounting for taxa potentially bearing edible fruits/products of known economic importance in Anatolia (Section 5.2.3). This trend is interpreted as resulting from an important phase of expansion of vineyards and orchards (Section 5.4.3), promoting a systematic exploitation of pruning residues for fuel purposes (Section 5.4.4).

Salicaceae (willow/poplar) charcoal is particularly abundant during period KH-P VB and KH-P IV, and to a lesser extent also during KH-P VA (Table 5.3, Figure 5.6 and 5.7). It might, thus, be reconstructed an intensive exploitation of riparian habitats for firewood purposes during the Iron Age. Riparian woodlands are expected to be associated with the humid environments fringing the site of

Niğde-Kınık Höyük, in connection to the Late Holocene remains of the Bor paleolake (Section 3.1.3) and the number of streams discharging into it.

An abrupt reduction in the relative abundance of willow/poplar charcoal is documented in the second half of the 1st millennium BCE (KH-P III and KH-P IIB) (Table 5.3, Figure 5.6 and 5.7). To date, pending high-resolution local paleoclimatic data, a climatic explanation of this drop appears unlikely. Paleoclimatic evidence from the Cappadocian limnological sequences of Eski Acıgöl and Nar Gölü suggests the presence of an important dry phase at ca. 1200 – 900 BCE (Roberts et al. 2016), followed by a degree of amelioration in the climatic conditions and a more stable increase in the moisture balance during the second half of the 1st millennium BCE (Allcock, 2017). Rather than to climatic factors, it is thus to date considered more plausible to ascribe the drop in Salicaceae to either changes in firewood preferences or to some forms of anthropic pressure on the riparian habitats. The latter hypothesis is consistent with the coeval evidence of intensification of arboreal crop cultivation (Figure 5.7), which might be reasonably considered indicative of a more generalized expansion of the agricultural landscape.

Fruit tree farming in central Anatolia generally necessitates a degree of irrigation during the summer dry months (Gorny 1995); it is thus possible that arboricultural expansion targeted areas in proximity to water sources, potentially resulting in partial clearance of the riparian vegetation. Furthermore, the hypothetical expansion and/or intensification of irrigation — due to the increased cultivation of water-demanding crops – could have caused a disruption in the natural hydrographic system, possibly resulting in a reduction of water entering the floodplain and consequently a contraction of the riparian habitats present in the proximity of the site. Pending geomorphological evidence this hypothesis remains, however, speculative. Finally, the overexploitation of willows and poplars for firewood purposes during the Early and Middle Iron Ages (KH-P V and KH-P IV) could have further contributed to their local decline. Although in lower quantities, Salicaceae charcoal is ubiquitously attested during KH-P III and KH-P II (Figure 5.7), pointing to the continued presence of riparian woodlands within the firewood catchment area of the site. Considering the ability of these taxa to colonize and grow rapidly (e.g., Dickmann and Kuzovkina 2014), their continuous presence in low numbers suggests an enduring anthropic pressure on these environments (Wright et al. 2015). Deciduous oaks, on the other hand, remain the dominant taxon throughout the 1st millennium BCE (Figure 5.7), indicating that the nearby mountain slopes were still, at least partially, forested and that the oak woodland was systematically exploited as a major fuel source. A complete clearance of the oak forest during the 1st millennium BCE is thus not observed, in line with the anthracological evidence from Kaman-Kalehöyük (Wright et al. 2015).

The archaeobotanical evidence dated to the recently identified Roman occupation of the site (KH-P IIA; Section 3.4.3) is, too date, too limited (Table 5.1) to allow any meaningful quantitative consideration. After the Roman occupation (KH-P IIA), following an occupation hiatus, the mound was resettled in the Seljuk/Early Ottoman period (KH-P I). The very ephemeral architecture defining these latest phases—limited to animal enclosures, pit houses, and possible retaining walls for tents (Highcock et al. 2015) – suggests the presence of a very modest rural settlement, consistent with an interpretation of the village as a seasonal campsite. Changes in the anthracological sequence in this latest occupation of the mound are interpreted as due to changes in vegetation community structure, the nature of occupation at the site, and potentially also to different cultural preferences of the inhabitants. Crabtree and Campana (2014) identify changes in diet and economy, and on the basis of the absence of pig remains in the KH-P I zooarchaeological record they suggest, with due caution, the presence of a Muslim village. Along these lines, the increased importance of *Amygdalus*-Type charcoal (Figure 5.7) could be due to cultural and economic orientations brought by the new groups settling this area. A degree of economic continuity is, however, documented by the continuous attestation of grapevine (as discussed in Section 5.4.3), although in lower frequencies than in previous periods (Figure 5.6 and 5.7). The simultaneous drop in oak use, for the first time in the sampled sequence (Figure 5.7), can be interpreted either as an indication of a significant contraction of the oak woodland directly impacting firewood availability or as resulting from the exploitation of the fuel resources available in the immediate proximity of the site rather than from the slopes of the surrounding mountains. The later hypothesis would suggest a shift towards using immediately available resources rather than an organized year-round exploitation of a greater diversity of regional landscape units, in line with the predictive model proposed by Asouti and Austin (2005) for nomadic communities. A reduction of the oak forest, on the other hand, is consistent with the coeval palynological evidence from Nar Gölü, in the Göllüdağ region (England et al. 2008). Thus, both hypotheses are potentially valid, and, perhaps more realistically, we should consider the possibility that the observed drop in oak charcoal originated from a combination of both factors.

In the following sections, the main trends here introduced will be further discussed, in terms of vegetation history (Section 5.4.2), agricultural activities (Section 5.4.3), and fuelwood acquisition strategies (Section 5.4.4).

5.4.2 *Late Holocene vegetation history in southern Cappadocia*

Today, most of our knowledge of Cappadocian Late Holocene vegetation relies on palynological sequences from the lake cores of Eski Acıgöl (Woldring and Bottema 2003) and Nar Gölü (England et al. 2008, Roberts et al. 2016), both of which lie in the Göllüdağ, north of the study region (Figure 3.1). Unfortunately, the second half of the Holocene is not represented in the nearby sequence of Akgöl Adabag (van Zeist and Bottema 1991: 75). Pending publication of the Neolithic and Chalcolithic results from Tepecik-Çiftlik, the only archaeobotanical sequence published from the broader region is from the Pre-Pottery Neolithic site of Aşıklı Höyük (Ergun et al. 2018). The archaeobotanical dataset from Niğde-Kınık Höyük can thus shed light on the Late Holocene vegetation history of the region, integrating and complementing the available palynological evidence.

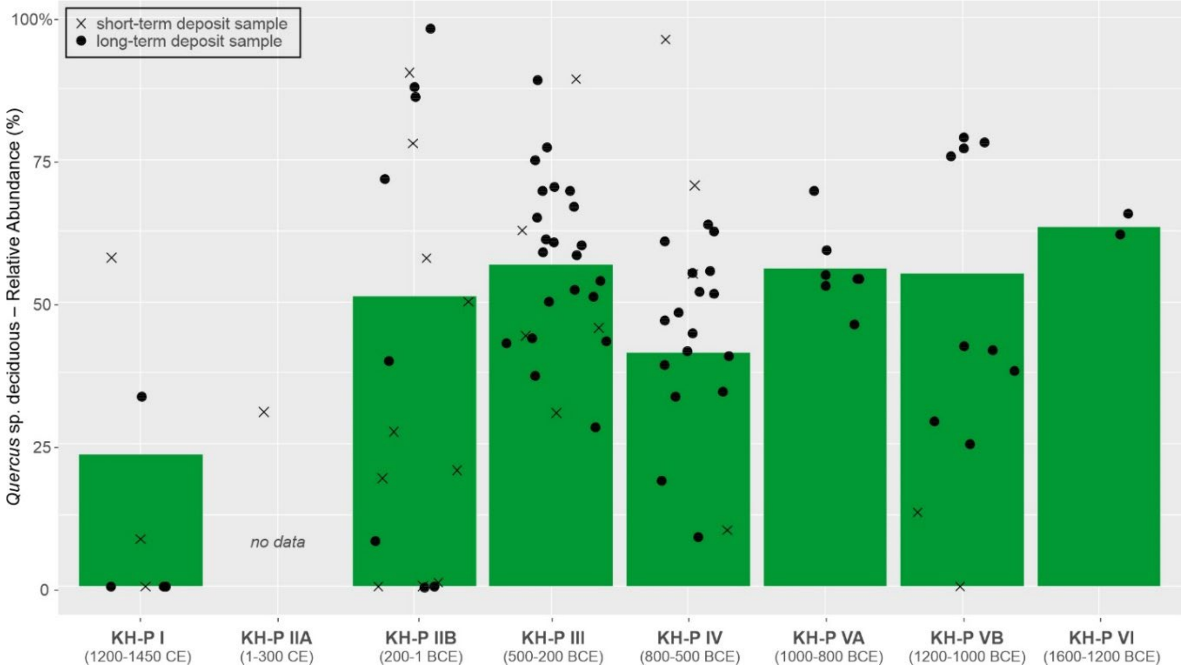


Figure 5.16 – *Relative abundance of* Quercus *sp. deciduous (deciduous oks) charcoal in the sampled anthracological sequence. The green bars represent the relative abundance of the taxon in an occupation period, calculated including only samples from long-term deposits. The circles (cross) represent the relative abundance of the taxon in each sample from long (short) term deposit. Only samples with <20 charcoal fragments are considered.*

As previously noted, deciduous oaks are the most common taxon throughout the entire anthracological sequence (Figure 5.16), in accordance with the vegetation history of the broader Irano-Anatolian region (Asouti and Kabukcu, 2014) and current local vegetation (Section 3.1.4). In the past, as today, oaks most likely grew on the slopes of the mountains present to the north of the site (Hasan, Keçiboyduran, and Melendiz; Figure 3.1), forming a forest best. The presence of oak populations in the floodplain should likely be excluded, considering the preference of this genus for well-drained soils (Asouti and Kabukcu, 2014).

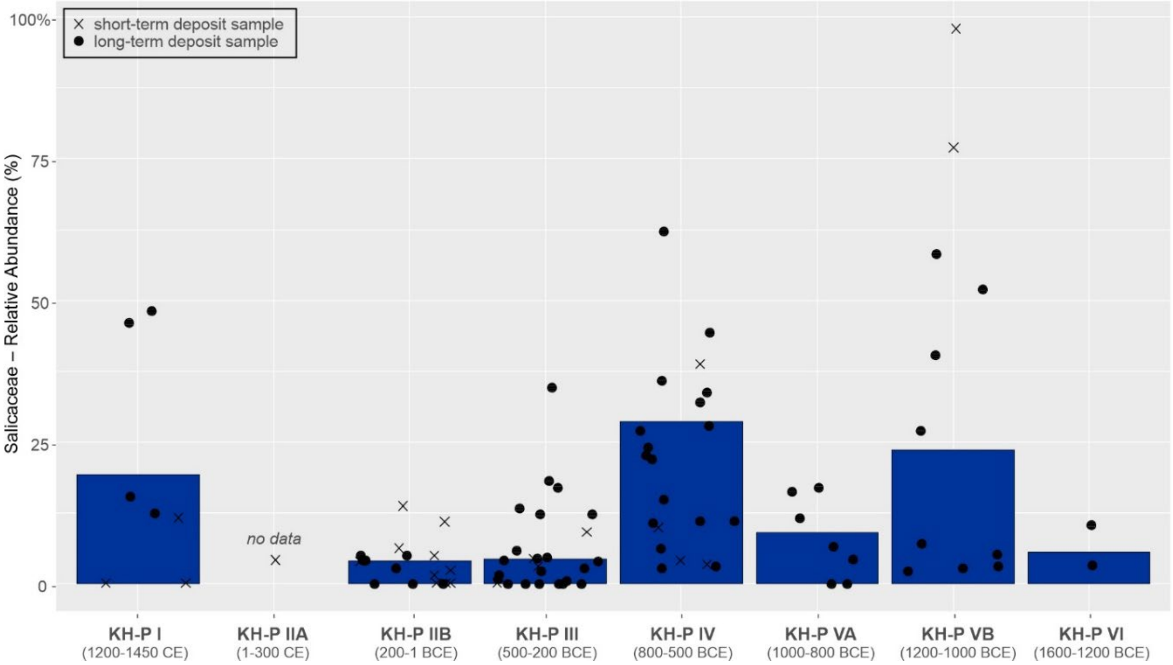


Figure 5.17 – *Relative abundance of Salicaceae (willow/poplar) charcoal in the sampled anthracological sequence. The blue bars represent the relative abundance of the taxon in an occupation period, calculated including only samples from long-term deposits. The circles (cross) represent the relative abundance of the taxon in each sample from long (short) term deposit. Only samples with <20 charcoal fragments are considered.*

The wetter soils present on the floodplain were suitable for riparian woodlands, abundantly documented in the sequence by Salicaceae charcoal and the sporadic attestations of *Ulmus*, *Celtis*, and

Tamarix (Table 5.3, Figure 5.6). Riparian habitats appear to have been particularly extensive during the earliest occupation periods of the site (KH-P VA and IV), and later reduced, likely as a result of some combination of fuel harvesting pressure and agricultural land expansion (as previously discussed in Section 5.3.1).

Pine charcoal is found in low amounts (Table 5.3, Figure 5.6), in glaring contrast to contemporary anthracological data from Gordion (Miller 2010, Marston 2017) and Kaman-Kalehöyük (Wright et al. 2017). The recognition of a minor contribution of pine to the Late Holocene vegetation of the study region closely parallels the current Cappadocian flora, characterized by no natural occurrences of this taxon (Section 3.1.4) (e.g., Woldring and Bottema 2003). Following these considerations, Woldring and Bottema (2003) interpreted the *Pinus* pollen record from Eski Acigöl as due to long-distance transport from the Taurus and Pontic mountain ranges. The same interpretation was more recently sustained by England et al. (2008) and Roberts et al. (2016) for the Nar Gölü sequence. In these terms, wood charcoal data from Niğde-Kınık Höyük confirms the marginal role of pine trees in the Late Holocene Cappadocian vegetation; although, the presence of some Scots/black pine charcoal suggests that limited populations of pine trees were likely present within the standard fuel catchment region of the site. The alternative hypotheses of either a northern expansion of the Taurus pine forest into the Bor-Ereğli Plain or of a significant larger firewood catchment area reaching the Taurus chain are discounted: the first hypothesis is rejected due to the presence in the southern portion of the Bor-Ereğli Plain of environments (wetlands and marshes; Fontugne et al. 1999) unsuitable for pine growth, and the second rejected because several urban centers lie in the surroundings of Kınık Höyük, presumably limiting the area exploitable for routine fuel acquisition well short of the Taurus.

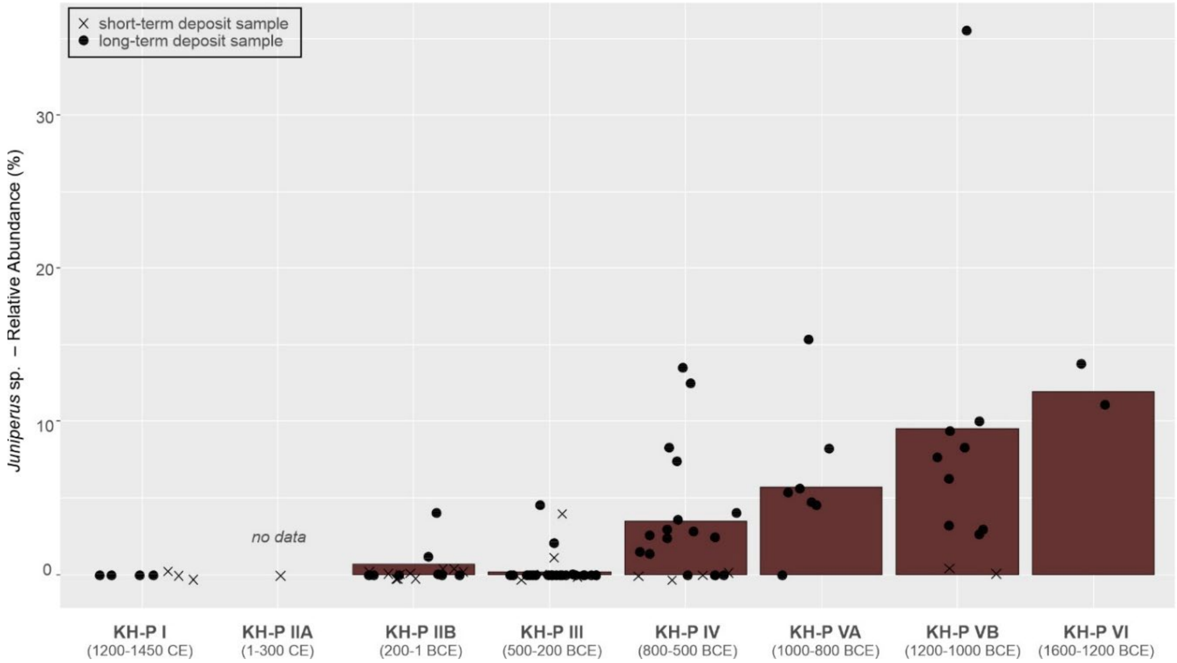
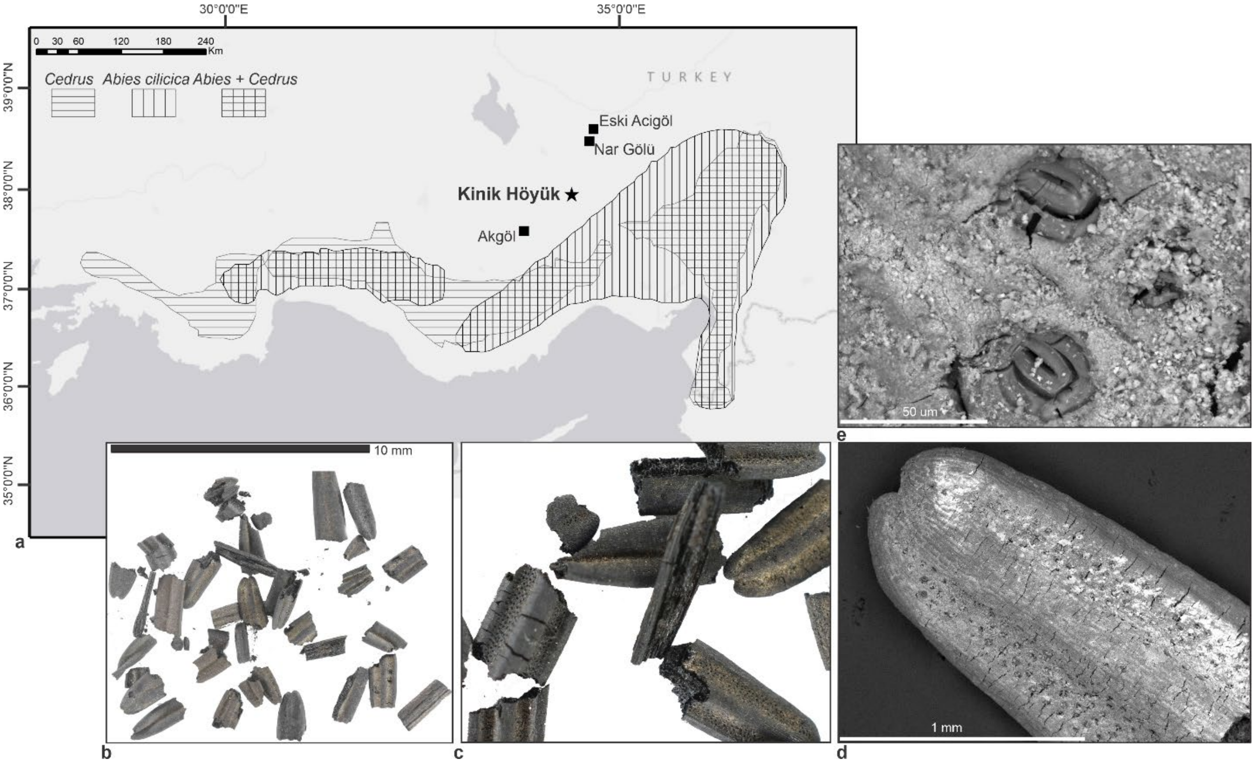


Figure 5.18 – *Relative abundance of* Juniperus *sp. (junipers) charcoal in the sampled anthracological sequence. The brown bars represent the relative abundance of the taxon in an occupation period, calculated including only samples from long-term deposits. The circles (cross) represent the relative abundance of the taxon in each sample from long (short) term deposit. Only samples with <20 charcoal fragments are considered.*

Juniperus shows an interesting trend in the sequence: attested in significant amounts during the earliest occupation periods (KH-P VI, V, and IV), the taxon becomes only sporadically documented in the Achaemenid and Hellenistic phases (KH-P III and II) and completely unattested during the Medieval occupation (KH-P I) (Figure 5.18). This progressively decreasing trend, leading to a complete disappearance of the taxon from the record, recalls similar dynamics documented at Gordion (Marston 2017:76). The evidence from Gordion is interpreted by Miller (2010) and Marston (2017) as resulting from an ecological succession trigged by forest clearance, with oaks replacing junipers due to the ability of the former to regrow more rapidly after cutting. Without fully ruling out alternative explanations, this interpretation might apply also for the record from Niğde-Kınık Höyük, considering the simultaneous evidence of expansion of arboriculture (Figure 5.7) as a possible indication of a more generalized intensification of anthropic pressure on the broader landscape.

Despite their sporadic attestation, worthy of note and discussion is the presence of *Abies* and *Cedrus* charcoal fragments within this anthracological record (Figure 5.6). Sharing similar ecological demands, today firs (*Abies cilicica*) and cedars (*Cedrus libani*) grow on the wetter slopes of the Taurus chain (Figure 5.19), often forming mixed stands (Atalay et al. 2014). Woldring and Bottema (2003) interpreted the relatively high percentages of *Cedrus* pollen from Eski Acigöl as possible evidence of a former northern expansion of the cedar forest during the wetter phases of the Holocene, reaching the Melendiz Mountain and possibly the Göllüdağ. The presence of sporadic *Cedrus* charcoal from Kınık Höyük might support this hypothesis of a former northern presence of the taxon, with relict populations still present in the Cappadocian Mountains during the Late Holocene and sporadically exploited by the local population.

The recycling for firewood of cedar timbers harvested for building or manufacture purposes on the south slopes of the Taurus cannot be fully ruled out, in light of the renowned construction and manufacture qualities of *Cedrus* wood and its documented extensive trade (e.g., Liphshitz and Bigger 1991). More explicitly indicative of a local occurrence is the exceptional discovery at the site of charred *Abies* (fir) needles (samples KIN15A1539s77 and KIN15B2113s108, both dating to KH-P II) (Section 6.3.6), likely incorporated into the archaeological record via burning ruminant dung as fuel (Figure 5.19). The co-occurrence of *Abies* needles and charcoal speaks more directly for the presence of this taxon in the proximity of the site, perhaps growing in the wettest areas of Melendiz Mountain (Figure 3,1). Although in low numbers, *Abies* pollen — which deposition is generally considered local (Pidek et al. 2013) – is documented in the Cappadocian pollen sequences (Woldring and Bottema 2003, England et al. 2008). *Abies* and *Cedrus* charcoal are unattested in the latest occupation phase (KH-P I), suggesting that by the early 2nd millennium CE those trees were no longer growing in the region.


30°0'0"E
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0 30 60 120 180 240
Km
Cedrus
Abies cilicica
Abies + Cedrus
TURKEY
Eski Acigöl
Nar Gölü
Kinik Höyük
Akgöl
39°0'0"N
38°0'0"N
37°0'0"N
36°0'0"N
35°0'0"N
a
10 mm
b
c
50 um
e
1 mm
d

Figure 5.19 – (*a*), *approximative distribution map of* Abies cilicica (*Taurus fir*) *and* Cedrus libani (*cedar*) *in Turkey* (*redrawn from Davis 1965*). *Sites discussed in the text in reference to those taxa are located in the map;* (*b*), *Abies sp. needle fragments from Kınık Höyük* (*sample KIN15A1539s77*); (*c*), *detail of b;* (*d*), *SEM photo of distal end of Abies needle from the same sample;* (*e*), *detail of d, picturing stomata.*

5.4.3 *Arboriculture in southern Cappadocia*

The wood charcoal assemblage from Kınık Höyük stands out for the abundant attestation of charcoal fragments from economic trees, as defined in Section 5.2.3 (Figure 5.6 and 5.7). Leaving to the next sections the contextualization of this evidence within a broader chronological and geographic scope, here the characteristics of the economic taxa in the Kınık Höyük record are discussed.

– *Rosaceae* (*rose family*)

It is difficult to interpret whether charcoal of the Rosaceae family is representative of dietary or economic roles (Table 5.3, Figure 5.6 and 5.7). Three main anthracological types were identified in this family: (*i*) Maloideae, which includes among others the genera *Malus*, *Pyrus*, *Sorbus*, *Crataegus*, Cydonia, and *Mespilus*; (*ii*) *Prunus*-Type, including among others *Prunus avium*, *P. cerasus*, *P. divaricata*, *P. domestica*, *P. mahaleb*, and *P. spinosa*; (*iii*) and Amygdalus-Type, including *Prunus persica*, *P. armeniaca*, *P. dulcis*, *P. webbii*, *P. korshinsky*, and *P. orientalis* (for identification criteria see Table SI2). Each type thus includes both cultivated and wild species, whose distinction on the basis of wood anatomy is either impossible or highly problematic (Schweingruber 1990). *Amygdalus*-Type is the only category of the Rosaceae which is interpreted (at least in part) as cultivated, considering its increase through the sequence (especially in the Medieval period, KH-P I) as reflecting a possible expansion of the cultivation of almond/peach/apricot trees. In addition to the taxonomic level of the identifications, the distinction between cultivated and non-cultivated Rosaceae is further challenged by a traditional intensive use of the wild species, exploited for both their edible fruits (e.g., *Mespilus*, *Crataegus*, *Pyrus*, and *Prunus*; see Doğan et al. 2004) and as rootstock for domestic varieties (Zohary et al. 2012).

The cultivation of apples, pears, plums, and other Rosaceae is well documented in the Anatolian historical record, starting from the Late Bronze Age (Section 2.3.2) (Hoffner 1974). It is interesting that the Hittite documents relatively frequently mention (e.g., Hittite Law §105; *Hoffner 1997*) mixed orchards, with grapevines ($^{\text{GIŠ}}$GIŠTIN) present together with several other fruit trees, such as apple trees ($^{\text{GIŠ}}$HAŠHUR), possibly pears ($^{\text{GIŠ}}$HAŠHUR.KUR.RA, literally ‘apples from the mountain/foreign land’), and possibly plums or medlars ($^{\text{GIŠ}}$SENNUR).

It should be mentioned, however, that the cultivation of most Rosaceae prior to a significantly later time is matter of debate, considering the assumed necessity of grafting to maintain selected characters in domesticated apple, pear, and plum trees, a technique allegedly considered to be a later (second half of the 1st millennium BCE) introduction in the Mediterranean (Zohary et al. 2012). Carpological remains of almond (*Prunus dulcis*), plum (*Prunus domestica*), and various Maloideae were, however, recently reported from the Middle Bronze Age site of Büklükale (Kırıkkale Province) (Section 7.3.2) (Fairbairn et al. 2019). In the carpological record from Niğde-Kınık Höyük only single seeds of apple/pear are documented (Chapter 6).

– Fraxinus (*ash*)

Fraxinus angustifolia/ornus (narrow-leaved or manna ash) is another taxon difficult to interpret. On the one hand, significantly earlier anthracological evidence from the nearby Konya Plain (Kabukcu 2017) clearly indicates that ash was a component of the regional vegetation; on the other hand, extensive palynological evidence indicates an abrupt increase in *Fraxinus ornus*-Type pollen during the Beyşehir Occupation Phase (Eastwood et al. 1998), regarded as indication of its cultivation for manna production (Bottema 2000), an important and often underestimated source of sugars.

In the Mediterranean basin manna is traditionally produced by extracting sap from *Fraxinus angustifolia* and *F. ornus* (Guarcello et al. 2019), planted in groves or present in the natural vegetation. Considering the possibility of the presence of ash trees (*F. ornus* or *angustifolia*) in the natural vegetation surrounding Niğde-Kınık Höyük, the appearance of the taxon alongside other important tree crops leaves open the possibility that it was exploited for manna extraction.

– Juglans regia (*walnut*)

Juglans regia (walnut) is attested as early as period KH-P III (Achaemenid/Early Hellenistic), then continuously documented, although in low numbers, during the rest of the sequence (Table 5.3, Figure 5.6 and 5.7). The domestication and cultivation history of the walnut is still poorly understood (Zohary et al. 2012). Regardless of the center of origin, after an almost total absence from the palynological record during the Early and Middle Holocene, in the late 2nd– early 1st millennia BCE *Juglans* pollen becomes abundantly attested in eastern Mediterranean sequences, suggesting its widespread cultivation (Bottema 2000). Data from Niğde-Kınık Höyük agrees with a diffusion of walnut cultivation during the 1st millennium BCE. In addition to wood charcoal evidence, the presence of walnut starting from period KH-P III (500-200 BCE) is documented also in the carpological record (Chapter 6).

– Elaeagnus angustifolia (*Russian olive*)

Together with walnut, *Elaeagnus angustifolia* (Russian olive) makes its first appearance in the Achaemenid/Early Hellenistic period (KH-P III) and thereafter is continuously attested (Table 5.3, Figure 5.6 and 5.7). In the plain surrounding the site, Russian olive is today very common along canals and roads and serving as living fences. In addition, its edible, elliptic-oblong fruits are widely consumed. Despite its abundant presence throughout Anatolia, the origin of this taxon and its status in the Turkish flora are still mostly unknown. Davis (1982) considered it an unlikely native species in Turkey, interpreting the widespread modern populations as resulting from the naturalization of feral populations, a process facilitated by its rapid growth and invasive character. This hypothesis is challenged by the occurrence of *Elaeagnus* pollen in sequences from the vicinity of Sagalassos around

2600 – 2500 BCE (Bakker et al. 2012). This palynological evidence remains singular in the Anatolian record, however.

In addition to the anthracological data from Niğde-Kınık Höyük, *Elaeagnus angustifolia* charcoal is attested in significant quantities in the Early and Late Medieval levels of Aşvan (Elazığ Province), where its sudden appearance is interpreted as indicating the introduction of this taxon sometime before, or during, the Medieval period (Willcox 1974). The evidence from Niğde-Kınık Höyük confirms the chronologically later role of *Elaeagnus* in the Anatolian vegetation, although it appears significantly earlier than at Aşvan, during the second half of the 1st millennium BCE. Its sudden appearance together with other fruit crops and its subsequent continuous attestation suggests that Russian olive was introduced as a cultivated crop. Considering the widespread attestation of the taxon in Central Asia, matched by relatively extensive archaeobotanical documentation (e.g., Hovsepyan and Willcox 2008, Smith et al. 2014, Spengler et al. 2018, Spengler and Willcox 2013), it is tempting to correlate its appearance to a Persian influence; although, first its status within the Anatolian flora must be clarified. The anthracological attestation of *Elaeagnus angustifolia* is corroborated by carpological evidence (Chapter 6) – dating as early as period KH-P III (500-200 BCE).

– Morus (*mulberry*)

Chronologically, *Morus* sp. (mulberry) is the latest arboreal crop attested in the sequence, documented only during the Seljuk/Early Ottoman period (KH-P I) (Table 5.3, Figure 5.6 and 5.7). Other published archaeobotanical evidence of mulberry from central Anatolia is limited to single finds of *Morus* sp. seeds from Hellenistic levels at Pessinonte (Peteghem 2005), a tentative identification (cf.

Morus sp.) of a significantly earlier (YHSS-4, 540 – 330 BCE) wood charcoal fragment from the site of Gordion (Miller 2010), and modern (19th century CE) evidence from Aşvan (Willcox 1974). The attestation of mulberry in Late Medieval levels matches the documented archaeobotanical record: from Central or East Asia, mulberry made its sporadic appearance in the Mediterranean during the 1st millennium BCE (e.g., 7th century BCE finds from Samos; Kućan 2000), but only becomes relatively common in the European and Mediterranean archaeobotanical record during the Medieval period (Livarda 2008). The introduction and increased importance of mulberry in late medieval Anatolia might have been promoted by the Central Asian heritage of Turkish populations and by the important role of sericulture during the Ottoman period (Yilmaz et al. 2015).

– Vitis vinifera (*grapevine*)

Grapevine (*Vitis vinifera*) is the most important arboreal crop in the sampled charcoal sequence. It is first attested during the Early Iron Age (KH-P V), with an increase in frequency during the Middle-Late Iron Ages (KH-P IV, relative abundance on fragment count 2%), but then reaching comparatively high values in the Achaemenid/Early Hellenistic (KH-P III, 16%) and Late Hellenistic (KH-P II, 26%) periods. *Vitis* charcoal is also abundant during the Seljuk/Early Ottoman occupation phase (KH-P I, 13%) (Figure 5.20). Pending further sampling of Late Bronze Age deposits, it is possible that the absence of *Vitis* from these levels is a result of limited sampling.

The distinction between wild (*Vitis vinifera* ssp. *sylvestris*) and domesticated (ssp. *vinifera*) grapevine wood on the basis of anatomy is not possible (although see Limier et al. 2018). However, the high relative frequencies of remains and the location of the site outside the expected geographic distribution of wild grapevine (Zohary et al. 2012) indicate that the finds from Niğde-Kınık Höyük are likely to represent cultivated varieties (Section 6.4.4). Thus, starting at least in the Iron Age, viticulture played a significant role in the economy of Niğde-Kınık Höyük, and during the Achaemenid and Hellenistic periods might have become a pivotal economic activity of regional importance (Section 6.4.4). The abundant presence at Niğde-Kınık Höyük of grape pips and pedicels, documented by the carpological study (Chapter 6), fully supports this reconstruction (Section 6.4.4).

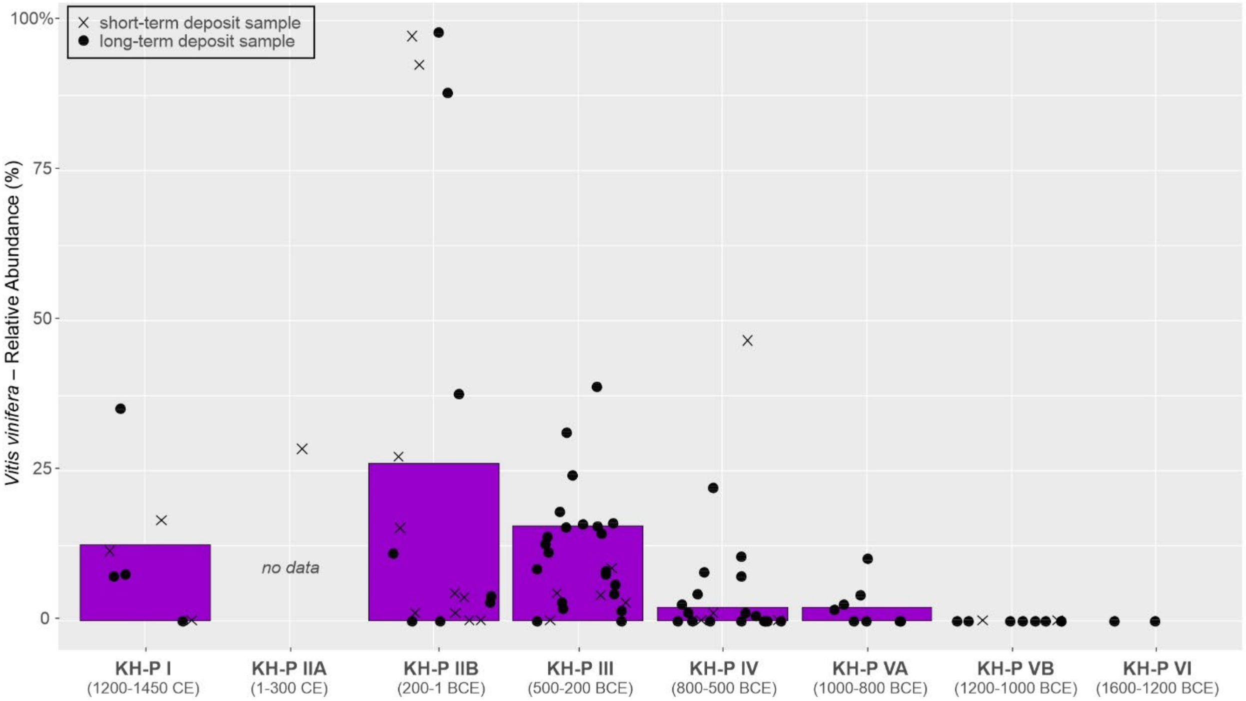

Figure 5.20 – *Relative abundance of* Vitis vinifera (*grapevine*) *charcoal in the sampled anthracological sequence. The purple bars represent the relative abundance of the taxon in an occupation period, calculated including only samples from long-term deposits. The circles* (*cross*) *represent the relative abundance of the taxon in each sample from long* (*short*) *term deposit. Only samples with <20 charcoal fragments are considered.*

With the sole exception of a single possible (cf. *Vitis*) identification from Çatalhöyük (Asouti 2005), grapevine charcoal is to date unreported in other central Anatolian anthracological sequences (e.g., Asouti 2003, Asouti and Hather 2001, Fairbairn and Wright 2017, Fairbairn et al. 2019, Kabukcu

2017, Longford et al 2009, Marston 2017, Masi et al. 2018, Miller 2010, Willcox 1974, 1991, Wright et al. 2015, 2017, Wright 2018) (Section 2.1.4). Grape seeds, on the other hand, are comparatively more frequently encountered in archaeobotanical samples from the Anatolian Plateau. As I will further discuss in Chapter 7, *Vitis vinifera* seeds are first attested in central Anatolia during the Early Bronze Age, and from then become a relatively stable component of the central Anatolian archaeobotanical assemblage, although typically found in low concentrations or individual finds. In contrast, *Vitis vinifera* seeds are found in large amounts in Mediterranean (e.g., Kilise Tepe, Tell Atchana, and Tell Tayinat) and southeastern Anatolian (e.g., Kenan Tepe and Hirbemerdon) sites (Chapter 7) (White and Miller 2018). Niğde-Kınık Höyük, in light of the extremely rich attestation of *Vitis vinifera* remains, clearly diverges from the pattern at today known known for the Anatolian Plateau, pointing to the high degree of complexity and specialization of Anatolian agropastoral economies and the still incomplete archaeobotanical knowledge that we have of them, as discussed below.

The evidence of grapevine cultivation from Niğde-Kınık Höyük is consistent with both local environmental conditions and the available historical and iconographic documentation. Favorable conditions for viticulture exist today in the Bor-Ereğli Plain (Bayer Altın 2008, Pfeifer 1957), with frequent feral populations of *Vitis vinifera* thriving in and around abandoned gardens, in addition to extensive vineyards (Section 3.2.2).

Historical and iconographic evidence points to both the antiquity and centrality of viticulture in the region of Niğde-Kınık Höyük. Most notably is the local Iron Age cult of the "Storm God of the Vineyard" (Luwian *Tahrunza*; Weeden 2018), a deity represented in a rich iconographic corpus from the region (Bor, Niğde, Keşlik Yayla, Gökbez, and Ivriz; Figure 5.21) as a standing figure holding bundles of wheat in one hand and bunches of grapes in the other, with fruit hanging from a vine growing from behind the deity (Figure 5.21).[30] Most of these reliefs are associated with Anatolian hieroglyphic inscriptions, dated to the late 8th – early 7th century BCE (Hawkins 2000) on the basis of synchronism of the local kings mentioned in the inscriptions (Tuwanean Dynasty of Warpalawa) with Assyrian rulers (Section 3.3.1).

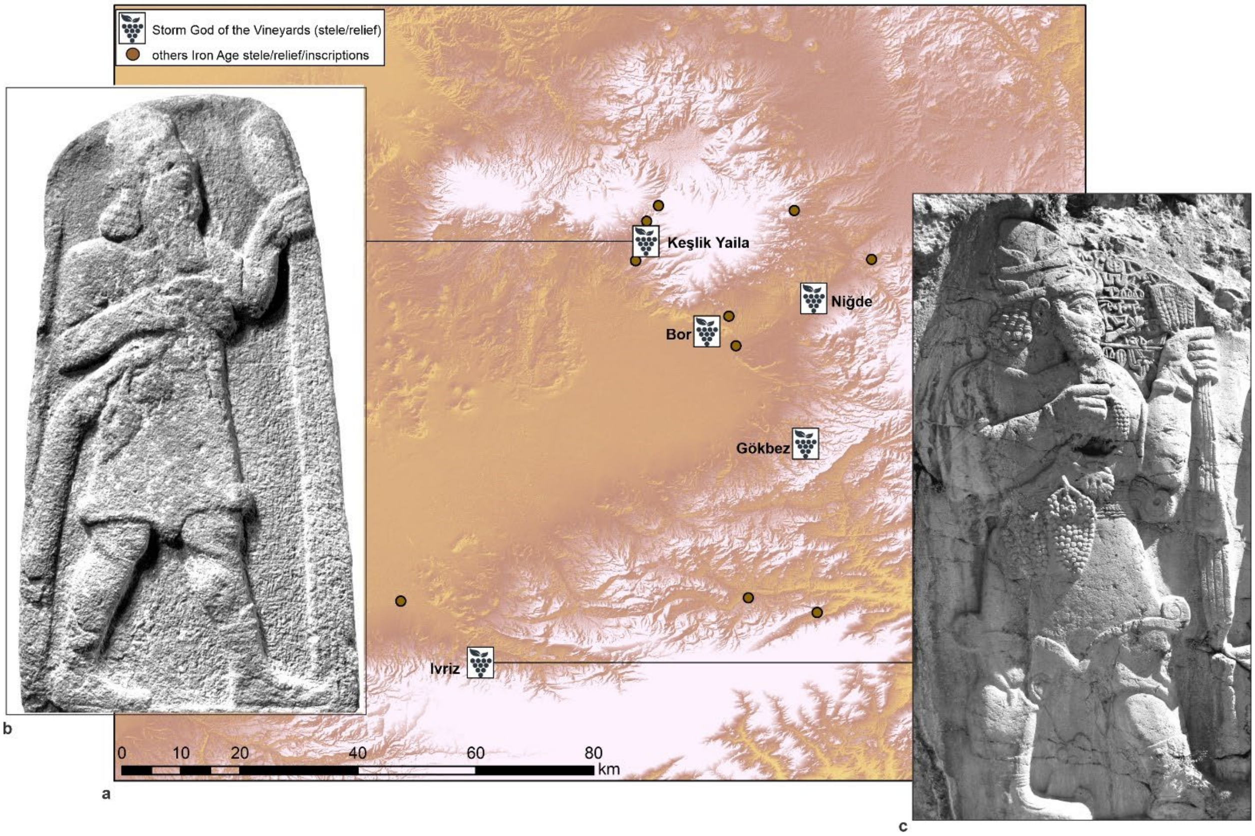
Storm God of the Vineyards (stele/relief)
others Iron Age stele/relief/inscriptions
Keşlik Yaila
Niğde
Bor
Gökbez
Ivriz
0
10
20
40
60
80
km
a
b
c

Figure 5.21 – (*a*), *map of the iconographic representation of the Storm-God of the Vineyard* (*Tarhunza*)*;* (*b*), *the Yeslik Yaila stele representing the Storm God of the Vineyard* (*after* Berges and Nollé 2000)*;* (*c*), *the Ivriz rock relief, detail of the Storm-God* (*after* www.hittitemonuments.com).

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[30] At Gökbez the Storm God is represented holding a double axe with one end and a lighting with the other, a vine with large bunches of grapes is growing in between the feet of the Storm God (Faydalı 1974).

In addition to a more generalized symbolic reference to agricultural abundance and prosperity (Masetti-Rouault 2004, Weeden 2018), this iconographic and epigraphic evidence is to be considered indicative of the importance of viticulture in the region during the Middle Iron Age. The presence of a vineyard and the production of wine is explicitly mentioned in the BOR 1 inscription (Hawkins 2000: 518–521), discovered at Kemerhisar (Ancient *Tuwana*) about 20 km to the southeast of Niğde-Kınık Höyük (Figure 5.21). The local cult of the Storm God of the Vineyard matches the period in which *Vitis vinifera* charcoal begins to increase in the anthracological sequence (Figure 5.20), pointing to the Iron Age roots of the centrality of viticulture, both in the cultural and economic life of local communities.

Among later historical sources, of interest is the description of Cappadocia provided by Strabo (Geography: XII, 1-2) (Section 2.3.4). The Greek 1st century BCE/CE geographer describes Melitene-Malatya (central-eastern Anatolia) as "*the whole of it* [Melitene] *is planted with fruit-trees, the only country in all Cappadocia* [here indicating the entire Asia Minor peninsula] *of which this is true, so that it produces, not only the olive, but also the Monarite wine, which rivals the Greek wines*" (Strabo, Geography: XII, 2, 1; Jones, 1928). In Strabo's account, the agricultural richness of Malatya is in open contrast with the otherwise barren Anatolia landscape, such as Mazaka-Kayseri: "*the districts all round are utterly barren and untilled, although they are level; but they are sandy and are rocky underneath. … therefore the necessaries of life must be brought from a distance*" (Strabo, Geography: XII, 2, 7; Jones 1928). The region of Niğde-Kınık Höyük, the historical Tyanitis, is only very briefly mentioned, yet meaningfully described as "*for the most part fertile and level*" (Strabo, Geography: XII, 2, 7; Jones 1928). The image of the Anatolian Plateau provided by Strabo is of a complex landscape in which agriculturally rich areas (e.g., Malatya and the Bor-Ereğli Plain) are interspersed among less productive and less fertile territories (e.g., Kayseri), highlighting in the former (explicitly in the case of Malatya) the presence of orchards and vineyards.

After the occupation hiatus, *Vitis vinifera* charcoal fragments continue to be abundantly attested during the Seljuk/Early Ottoman period (KH-P I) (Figure 5.20). Thus, viticulture retained an important role also after the region was incorporated into the Seljuk and the Ottoman Empires, as supported by documentary evidence. Ottoman archival tax records from the nearby town of Bor (ca. 15 km east of Niğde-Kınık Höyük) record large and economically remunerative vineyards in the town territory (Balta 2017). The documentary evidence from Bor fits the general image of Cappadocia emerging from the 15th and 16th centuries CE Ottoman sources as a region characterized by thriving viticulture and wine production, with both the sizable local Christian communities and Muslim villages involved in these activities (Balta 2017). The evidence of viticulture, including both wood charcoal and seeds/fruit remains, will be discussed extensively in Section 6.4.4.

5.4.4 Agricultural byproducts as firewood resources

In addition to providing evidence of the expansion of arboriculture and viticulture, the wood charcoal record from Niğde-Kınık Höyük permits to investigate firewood exploitation strategies in relation to broader changes in the agricultural system. It is, in fact, a likely hypothesis that the expansion of the farmed land promoted intensive use of the increasingly available biomass produced by agricultural activities, including pruned wood. The anthracological evidence supports this hypothesis, indicating that from the second half of the 1st millennium BCE (KH-P III, 500-200 BCE and KH-P IIB, 200-1 BCE), the local population intensively exploited for firewood purposes these locally abundant agricultural byproducts, especially grape cuttings.

Viticulture by definition implies pruning and trimming, activities necessary in order to impose a training to the vines and ensure stable fruit production (e.g., Reynolds and Vanden Heuvel 2009). The biomass produced by those activities on a yearly basis is hardly negligible, as exemplified by the general estimation for modern vineyards of 5 tons of pruning residues produced for each hectare under cultivation per annum (Yeniokan et al. 2014). The extensive vineyards present in the surrounding of Niğde-Kınık Höyük would have surely provided a sizeable quantity of pruning wood, the use of which for firewood in a poorly forested landscape is expected. Historical evidence of grape pruning in Anatolia is scattered yet present, dating as far back as the Hittite period (see discussion provided in Section 2.3.2) and abundantly documented afterwards in the iconography of Roman stone monuments from Phrygia (Waelkens 1977).

The exploitation of agricultural biomass as a firewood is suspected to be particularly evident in anthracological sequences from regions in which limited woodland cover promotes such exploitation contemporaneous with phases of intensification of arboricultural activities. Interestingly, similar anthracological patterns, characterized by extensive use of pruned wood for fuel, have been described in the southern Levant (Fall et al. 2002), a semi-arid region where arboriculture has a significantly longer history.

5.5 An anthracological signature of the Beyşeir Occupation Phase

In the previous sections, it was argued that the anthracological sequence from Niğde-Kınık Höyük provides evidence of an important phase of agricultural expansion characterized by arboreal crop cultivation, possibly to be connected to a degree of woodland clearance. This evidence closely matches the palynological record of southwestern and southcentral Anatolia (Section 2.2.2), which documents a well-defined regional phase of deforestation, agricultural expansion, and arboriculture known in the literature as the "Beyşehir Occupation Phase" (Bottema et al. 1986, 1990, Eastwood et al. 1998, Roberts 2018, van Zeist et al. 1975, Woodbridge et al. 2019) – a topic that I will further discuss in Section 7.2.2.

The Beyşehir Occupation Phase is a coherent palynological phase defined by (*i*) an abrupt, marked decline in forest pollen; (*ii*) increase of cereal-Type pollen and other grasses; (*iii*) presence and increased attestation of pollen of arboreal crop taxa (e.g., *Olea europaea*, *Juglans regia*, *Fraxinus ornus*, *Castanea*, *Pistacia*, *Vitis vinifera*, and *Platanus*). In addition to southwestern and southcentral Anatolian sites, coeval evidence from northern and western Anatolia, Cyprus, and the Levant (Roberts 2018) clearly indicates the supraregional character of this phenomenon. Roberts (2018) recognizes the regionally differential onset of this phase, clustered in three main periods: 2nd millennium BCE; early 1st millennium BCE (8th 10th century BCE); and mid-1st millennium BCE (6th-3rd century BCE). The end of this palynological phase is more consistently dated across its broad geographic spread, with a generalized abrupt end in the mid-1st millennium CE, after which follows a rather abrupt forest expansion (especially of *Pinus*) and the almost complete disappearance of arboreal crop pollen.

In contrast to the abundant palynological evidence, prior to this study the Beyşehir Occupation Phase has never been directly linked to any Anatolian archaeobotanical sequence, due in part to poor archaeobotanical sampling of much of the Anatolian Plateau during the Late Holocene, including

Cappadocia, the Konya Plain, and the Pisidian Lake District, which are the regions in which this phase is expected to be found. The wood charcoal evidence of fruit growing from Niğde-Kınık Höyük closely matches the chronology of the Beyşehir Occupation Phase as documented in the Cappadocian pollen sequences of Nar Gölü (England et al. 2008) and Eski Acigöl (Woldring and Bottema 2003), thus evidently providing for the first time an anthracological signature of this phenomenon (Figure 5.22).

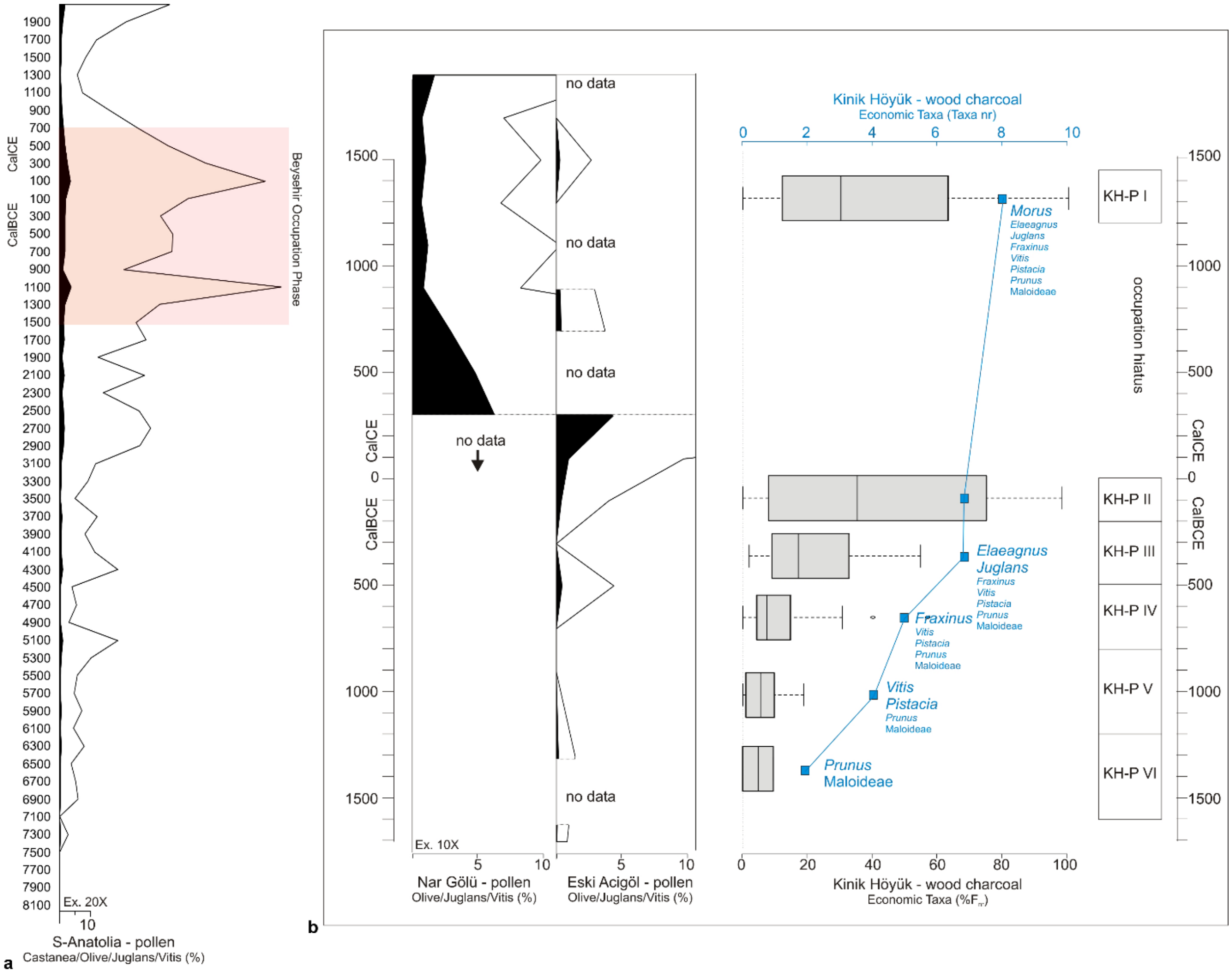

Figure 5.22 – *a, cumulative palynological record for* Castanea/Olea/Juglans/Vitis *in S-Anatolia (data from Woodbridge et al. 2019) (allow line 20X exaggeration). The red box indicates the regional upper and lower limits of the Beyşehir occupation phase; b, Late Holocene palynological record for* Olea/Juglans/Vitis *at Nar Gölü and Esli Acigöl (Cappadocia; data from Woodbridge et al. 2019) compared to the anthracological record of economic taxa from Kınık Höyük, here represented as boxplots (outliers are detected through Interquartile Range Rule) and number of economic taxa identified for each occupation period.*

In comparing the anthracological evidence from Niğde-Kınık Höyük to coeval central Anatolian palynological sequences, the respective interpretative limits of wood charcoal and pollen analysis need to be critically considered (Emery-Barbier and Thiebault 2005, Nelle et al. 2010). In off-site pollen profiles, the taphonomic processes accounting for pollen deposition translate into frequent issues of long-distance transport of pollen grains (Gaillard et al. 2008) and a systematic underrepresentation of taxa that are predominantly non-wind pollinated (Prentice 1988) (Section 2.2.1). These considerations are particularly important for the history of arboriculture, as well-exemplified by the evidence here discussed. The record of fruit-growing from Niğde-Kınık Höyük is characterized by taxa dominantly entomophilous or self-pollinated – such as *Vitis* (most likely domesticated), Rosaceae, and *Elaeagnus* (Turner and Brown 2004, Pan et al. 2011) – which are expected to be systematically underrepresented (*Vitis*) or entirely absent (Rosaceae, *Elaeagnus*) in pollen diagrams. It is, thus, possible to propose that these crops were an important additional component of the agricultural landscape associated with the Beyşehir Occupation Phase, undetected or overlooked in the palynological sequences.

In contrast, *Olea* (olive) is completely unattested in the wood charcoal record from the site, in clear mismatch with the palynological evidence from the Cappadocian sequences of Eski Acigöl (Woldring and Bottema 2003) and Nar Gölü (England et al. 2008). Considering the abundant pruning required for olive farming, the lack of any charcoal points to the absence of olive groves in the surroundings of Niğde-Kınık Höyük. Thus, the palynological evidence of *Olea* from cores in Cappadocia can be explained as a local specialization within that region, as a prerogative of the Roman and Byzantine periods (not covered by the Niğde-Kınık Höyük sequence), or—perhaps more realistically– regarded as an indication of the extra-Cappadocian origin of the *Olea* pollen detected in them (see

England et al. 2008 and 2021 for a discussion).

The diachronic analysis of the arboreal crop record from Niğde-Kınık Höyük suggests that in southern Cappadocia the beginning of the Beyşehir Occupation Phase was gradual rather than abrupt, and in cultural continuity rather than in rupture with the older milieu. This interpretation is based on the explicit emphasis on viticulture in the local cult of *Tarhunza* (Weeden 2018), a deity stemming from the Late Bronze Age milieu. Cultural continuity in the region between the Late Bronze and Iron Age has already been stressed based on several lines of evidence (Section 3.3.2) (Mora and d'Alfonso 2012a), including the role played by agriculture and agricultural infrastructure in the regional political economy (Chapter 4) (Castellano 2018). The increase in arboreal crops at Niğde-Kınık Höyük during periods KH-P V and IV can be, thus, understood as a gradual process of anthropogenic transformation of the landscape, culminating in the marked changes in the anthracological record during the Achaemenid/Early Hellenistic period (KH-P III) that extend into the Late Hellenistic phase (KH-P II). This trend is further corroborated by the carpological evidence presented in Chapter 6.

Due to the hiatus in occupation following period KH-P IIB (1-300 CE), evidence from Niğde-Kınık Höyük does not cover the expected end of the Beyşehir Occupation Phase, generally dated in pollen sequences to the mid-1st millennium CE. Medieval Cappadocia, however, seems to follow a specific trajectory connected to local historical developments (Eastwood et al. 2009, Roberts 2018, Roberts et al. 2018). The consolidation of the border with the caliphate and the cessation of Arab armies' raids in Cappadocia allowed Byzantine resettlement of the countryside during the late 9th – early 10th century CE, which in turn promoted a new phase of forest clearance and agricultural expansion

(Allcock 2017, Eastwood et al. 2009, Roberts 2018). Although short-term fluctuations in anthropogenic and arboreal pollen are thereafter detected, the mid-Byzantine land use system is considered to continue into the Seljuk and Ottoman periods (Eastwood et al. 2009). On the basis of the pollen data from Nar Gölü, Eastwood et al. (2009) and Roberts (2018) interpreted the Late Medieval agrarian system as distinct from the previous Classic and Late Antique landscape, with agricultural production in the newly repopulated countryside focusing on cereal production and pastoralism rather than on arboriculture. This hypothesis could be in part challenged by the chronologically later (1200 – 1450 CE) evidence from Niğde-Kınık Höyük, in which arboreal crops are comparatively still abundantly attested. This mismatch is likely attributable to the poor palynological representation of the taxa that form the arboreal crop record at Niğde-Kınık Höyük. The presence of local arboriculture is further corroborated by the aforementioned 15th and 16th centuries CE documentary evidence (Balta 2017), which confirms the key economic role of fruit-growing in Cappadocia, in continuum with the earlier agricultural tradition.

5.6 Conclusions

The anthracological sequence from Niğde-Kınık Höyük (southern Cappadocia), spanning from the Late Bronze Age to the Seljuk/Early Ottoman period, fills a long-standing gap in Anatolian archaeobotanical research. Wood charcoal analysis illuminates the Late Holocene vegetation history of the region and its diachronic change (Section 5.4.2) and suggests that the floristic distinctiveness of southern Cappadocia is rooted in local vegetation history. The results confirm the minor role played in the regional flora by conifer trees, especially pine, but suggest the possible former presence in the Cappadocian mountains of relict populations of fir (*Abies cilicica*) and cedar (*Cedrus libani*), supporting the hypothesis of an earlier northward expansion of those taxa during the wettest phases of the Holocene. Furthermore, anthracological data provides a remarkable record of arboriculture, (Section 5.4.3) without to date any comparanda in the Anatolian archaeobotanical record but closely matching the Beyşehir Occupation Phase phenomenon (Section 5.5) a major phase of land-cover change documented in contemporaneous palynological sequences. This distinctive anthracological association indicates how intensification of agricultural activities impacted the use of specific types of wood as fuel through time. (Section 5.4.4).

The anthracological evidence from Niğde-Kınık Höyük thus corroborates and supports regional and supraregional palynological evidence (Roberts 2018) of large-scale landscape transformation in the 1st millennium BCE, with radical changes in land cover resulting from an unprecedented increase in human activities. Economic and demographic dynamics (Woodbridge et al. 2019) and increased interregional connectivity (e.g., Sherratt and Sherratt 1993) surely played a crucial role in promoting this phase of land-cover modification, with intensified agricultural production aiming to feed expanding demand for commodity crops and/or products obtained from them (e.g., wine). In the specific case of southern Cappadocia, the earliest stages of this process of landscape transformation are coupled with a new emphasis on agricultural production in the epigraphy and iconography of display monuments, as documented in the local Iron Age cult of Tahrunza of the vineyard (Weeden 2018).

As I will further discuss in Chapter 7, while agricultural intensification documented at Niğde-Kınık Höyük fits well into this supraregional trend, the archaeobotanical evidence of extensive fruit cultivation documented in this study is currently unmatched by any other archaeobotanical sequence from the Anatolian Plateau. The uniqueness of this evidence should be weighed in light of the still-limited archaeobotanical picture of Asia Minor (Section 2.1.3), a region characterized by a complexity of environments, ecologies, cultures, and economies—a heterogeneity already appreciated by ancient geographers, such as Strabo (Geography: XII,1-2). The Late Holocene phase of land-cover change thus occurred differently in different regions of the Plateau, according to specific socio-cultural and ecological realities. Within this generalized intensification of agropastoral activities, the economic importance of fruit growing might have been limited to specific regions of the Plateau, perhaps where such cultivation was favored by higher water availability sustaining irrigation systems, crucial given extended summer droughts typical of the central Anatolian climate. Southern Cappadocia was surely one of these regions, together with the Pisidian Lake District (palynological evidence; Roberts 2018) and Malatya (textual evidence; Strabo Geography: XII, 1-2). It is the task of future archaeobotanical research to uncover and understand these local trajectories that underlie the broader supraregional trend well documented in palynological records.

Starting from the mid-1st millennium BCE, the evidence from Niğde-Kınık Höyük points to a remarkably high degree of continuity despite the eventful southern Cappadocian political history (on the local traditional agropastoral system see Section 3.2). This continuity in arboricultural practices was potentially driven by the environmental setting (e.g., abundance of water sources; Section 3.1.3) and the high degree of cultural continuity in this region through the ages (e.g., in the transition from the Late Bronze to the Iron Age, or from the Late Antique to the Medieval period) (Section 3.3). In these terms, the current landscape surrounding the archaeological site of Niğde-Kınık Höyük, with deforested mountain slopes, but lush orchards and vineyards, might be seen as the final result of these processes, emerging from the long and complex history of confrontation between local populations and their biotic and abiotic surroundings.

5.6 Summary

In this chapter, I have presented the results of the wood charcoal study conducted on samples from the archaeological site of Niğde-Kınık Höyük, covering the period between the Late Bronze Age (KH-P VI, 1600-1200 BCE) and the Late Hellenistic period (KH-P IIB, 200-1 BCE). Additional samples were analyzed also from Seljuk/Ottoman occupation (KH-P I, 1200-1450 CE). This evidence allowed me to discuss the local and regional Late Holocene vegetation history (Section 5.4.2), to shade light on arboricultural activities in the southern Cappadocian landscape (Section 5.4.3), and to assess the impact of the later on firewood exploitation strategies (Section 5.4.4). Based on wood charcoal evidence, deciduous oaks (*Quercus* spp. deciduous) was the dominant component of the local vegetation. Phytogeographic and ecological consideration suggest that, same as today, oaks were growing on the slopes of the mountains fringing the Bor Plain, forming a belt of cold deciduous forest/scrub. The wood charcoal evidence suggests, furthermore, that riparian woodlands were formerly more extended. This hygrophilous vegetation was intensively exploited for firewood purposes during the earlier periods in the sampled sequence (KH-P VB, KH-P VA, KH-P IV; 1200-500 BCE). Riparian woodlands were very likely associated to the humid ecosystems present in the floodplain and along the perennial and seasonal water courses discharging into it. The drop in Salicaceae charcoal, starting from the mid-1st millennium BCE, is interpreted as resulting from a contraction of the riparian woodlands, resulting from a combination of firewood overexploitation, clearances in the plain, and the generalized reduction of humid environments due to an increased anthropic pressure.

A remarkable and, in the Anatolian context, unique aspect of the anthracological record from Niğde-Kınık Höyük is the abundant and ubiquitous presence of grapevine (*Vitis vinifera*) charcoal. *Vitis* charcoal is found starting from period KH-P VA (1000-800 BCE), and from then progressively increases in abundance during the following periods, peaking during the second half of the 1st millennium BCE (KH-P III and KH-P IIB). Other evidence also points to the presence of thriving viticulture in southern Cappadocia, the abundance of grapevine charcoal suggests that vineyards pruning residues were systematically exploited as firewood resource. The later was, thus, an activity fully integrated in the broader agricultural landscape. The expansion of viticulture is coupled by more generalized evidence of tree-crops cultivation, which included, based on wood charcoal evidence, walnut, Russian olive, and possible different members of the Rosaceae family.

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In this chapter, I have reconstructed, based on wood charcoal data, the local landscape history. Wood charcoal evidence points to the presence in 1st millennium BCE southern Cappadocia of a thriving agricultural industry, in which viticulture and arboriculture played a pivotal role. Which staples crops were part of this economic system? Is there any diachronic trend in these regards? In addition to trimming residues, does also dung play a role in firewood activities? Which type of ruderal and weedy flora is associated to this landscape? In order to answer these, and other, questions, in the next chapter (Chapter 6) I will present the results of the carpological study.

CHAPTER 6

Carpological analysis: agriculture, diet, and vegetation in southern Cappadocia in the late 2nd and 1st millennia BCE

In the previous chapter (Chapter 5), I presented the results of the wood charcoal study conducted on samples from the archaeological site of Niğde-Kınık Höyük, extending from the Late Bronze Age (KH-P VI, 1600-1200 BCE) to the end of the Late Hellenistic period (KH-P IIB, 200-1 BCE), with the addition of samples originating from the Seljuk-Ottoman occupation of the site (1200-1450 CE). Wood charcoal analysis allowed me to shed light on the vegetation history of southern Cappadocia (Section 5.4.2), on the development of arboriculture in the landscape surrounding Niğde-Kınık Höyük (Section 5.4.3), and on the impact of tree-crop farming on local firewood exploitation strategies (Section 5.4.4). The information obtained from wood charcoal analysis can be complemented by the study of carpological remains (seeds/fruits). By including in archaeobotanical research both types of macro-botanical evidence, it is possible to obtain a more comprehensive and robust reconstruction of past vegetation dynamics and agricultural activities. The aim of this chapter is, thus, to present and discuss the result of this second component of the archaeobotanical study conducted at Niğde-Kınık Höyük.

6.1 Introduction: carpological analysis at Niğde-Kınık Höyük

Seed/fruit remains are commonly found throughout archaeological deposits, reflecting the number of activities which, directly or indirectly, involve plant materials. A wide range of depositional pathways underlies the incorporation of carpological remains in the archaeological deposit, from the intentional use of the plant parts themselves (direct anthropogenic), to their deposition as by-products of other activities (indirect anthropogenic) (Minnis 1981, Gallagher 2014, Pearsall 2015: 35-40). With the notable possible exception of waterlogged sites (Jacomet 2013), natural depositional processes (e.g., 'seed rain') (Minnis 1981: 145-146) represent a secondary vector of deposition.

Because of the organic nature of plant tissues (Ford 1979, Greenwood 1981, Gallagher 2014: 20, Pearsall 2015: 40-44), specific depositional environments (e.g., waterlogged, hyper-arid) or transformation processes (e.g., mineralization, charring) must occur to allow preservation (e.g., Caple and Dungworth 1997, McCobb et al. 2001, van der Veen 2007, Moulherat et al. 2002, Jacomet 2013, Gallagher 2014: 20-28). In central Anatolia, and more in general in non-waterlogged or non-hyper-arid depositional environments, the preservation of plant remains occurs chiefly though charring (see Section 6.3.1). Under these circumstances, it is implied that the majority of recovered plant materials have been exposed to fire, either as part of the original activities that led to their deposition (e.g., cooking), accidentally (e.g., plant parts present in proximity to a fire installation), or during conflagrations (e.g., destruction levels) (van der Veen 2007).

I provided a general introduction to the study of carpological remains in Section 2.1.1, to which I refer the reader for a discussion of the depositional and post-depositional processes determining the formation of the carpological record. The seed/fruit assemblages resulting from these processes represent a stratified 'archive' directly informing on past agriculture, diet, and vegetation. Based on this set of evidence, with this component of the dissertation project, I intend to discuss: (*i*) the agricultural system orbiting around the site of Niğde-Kınık Höyük; (*ii*) the activities involving plant materials that were conducted in different locations of the sites; and (*iii*) the local wild and weedy flora occurring in the various habitats present in the landscape surrounding the settlement.

Carpological research was conducted on a total of 174 flotation samples, leading to the analysis of more than 51,000 countable non-woody plant parts. In Section 6.2, I outline the methodology used in this study, which is followed by a presentation of the results concerning economic plants and the wild/weed flora (Section 6.3). In the discussion, I assess both the diachronic (Section 6.4.1 and 6.4.2) and spatial (Section 6.4.3) trends detected in the dataset. Specific attention is given to the evidence of viticulture (Section 6.4.4). For background information on the site periodization and location of the trenches, as well as for a more general introduction to southern Cappadocian climate, vegetation, history, and archaeology, see Chapter 3.

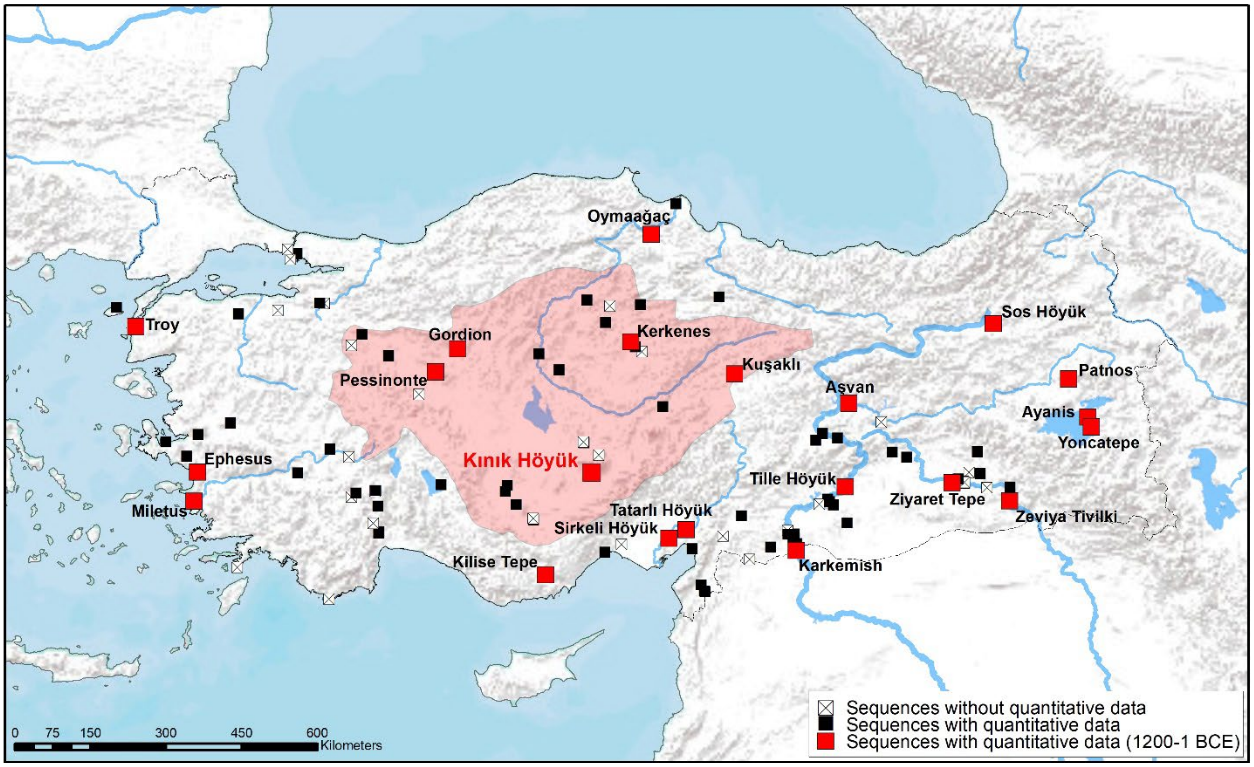
Oymaağaç
Sos Höyük
Troy
Gordion
Kerkenes
Kuşaklı
Pessinonte
Aşvan
Patnos
Ayanis
Yoncatepe
Ephesus
Kınık Höyük
Tille Höyük
Miletus
Ziyaret Tepe
Tatarlı Höyük
Zeviya Tivilki
Sirkeli Höyük
Kilise Tepe
Karkemish
☒ Sequences without quantitative data
■ Sequences with quantitative data
🟥 Sequences with quantitative data (1200-1 BCE)
0 75 150 300 450 600
Kilometers

Figure 6.1 – *Location of Niğde-Kınık Höyük and other published carpological sequences (seed and fruit remains) from modern Turkey. The central Anatolian Plateau is highlighted. The red squares indicate the published carpological sequences dated to periods comprised between 1200 to 1 BCE.*

6.2 Materials and Methods

6.2.1 *Sampling strategy*

The carpological study was conducted on the same flotation samples (total 174; 10-15 liter/sample) that were considered for wood charcoal analysis (Chapter 5). Both sampling and sample selection strategies were, thus, designed to maximize the information obtained by a combined analysis of these the two datasets. Table 6.1 summarizes the materials available for each occupation period, specifying their attribution to different operations and depositional contexts. Because of limited sampling, the evidence from periods KH-P VI (1600-1200 BCE) and KH-P IIA (1-300 CE) will not be included in figures and elaborations, if not otherwise indicated. Sample-by-sample information is provided in Appendix 3. The sampling strategy used in this study is outlined in detail in Section 5.2.1.

			Operations				Contexts type				
Period	**Chronology**	**Tot**	A	B	C	D	Acc.	Fill	Pyro.	Surf.	fire l.
KH- P I	(1200-1450 CE)	25	–	25	–	–	7	11	2	5	–
KH- P IIA	(1-300 CE)	2	2	–	–	–	–	–	–	2	–
KH- P IIB	200-1 BCE)	39	17	19	–	3	12	12	10	5	–
KH- P III	(500-200 BCE)	56	24	13	–	19	31	5	12	7	1
KH- P IV	(800-500 BCE)	31	8	–	23	–	15	10	2	4	–
KH- P VA	(1000-800 BCE)	10	6	–	4	–	10	–	–	–	–
KH- P VB	(1200-1000 BCE)	9	–	–	9	–	6	1	–	–	2
KH- P VI	(1600-1200 BCE)	2	–	–	2	–	1	1	–	–	–

Table 6.1 – *Kınık Höyük occupation periods and number of samples considered in this study, distributed for operation and context type. Acc. = accumulation, Fill = fill of a pit or other (non-pyrotechnological) structures; Pyro. = samples associated to pyrotechnological structures (e.g., hearths, ovens); Surf. = occupation surfaces; fire l. = fire layers.*

6.2.2 *Samples preparation*

As I discussed in Section 5.2, samples were processed using both manual (wash-over technique and bucket flotation, Pearsal 2005: 50-51) and machine assisted (Siraf-Type, Williams 1973) flotation. The latter technique was introduced by the author at a later stage of the project, to maximize the amount of sediment that could be processed in an excavation season. Flotation was conducted using water from an aqueduct, available at the excavation house. The overflowing water was channeled and redistributed to irrigate the excavation house garden. The preparation technique used for each sample is listed in Appendix 3. Prior to processing, the volume of each sample was measured using a graduated container. Machine-assisted flotation was conducted using an adapted tank (Nesbitt 1995), with mesh size of 1-mm for the heavy faction and <0.1 mm for the light fraction. Sample processing was repeated until macroscopic floating materials were no longer visible, which on average occurred after about 30 to 45 minutes. The resulting heavy faction was subjected to wash-over processing, a two-step protocol that allowed to further enhance the retrieving rate. The heavy fraction was left to dry under the sun, and subsequently screened for artifacts, micro-faunal remains, and non-floating botanical macroremains. The light fraction was collected in cloths (mesh-size <0.1 mm) and hung to dry indoors. Once dried, the light factions were packed in double plastic bags, and stored in plastic containers. The light fractions were subsequently shipped to the archaeobotanical lab established by the author at New York University. Export permits were granted by the competent Turkish authority until 2018. The samples processed in the following campaigns have been analyzed on site, following an ad-hoc protocol. These latter materials are, however, not included in the dissertation project.

6.2.3 *Sorting and identification of plant parts*

Once the samples arrived at the lab, the light fraction was processed using a column of stackable geological sieves (mesh size of 4, 2, 1, 0.5, and 0.25-mm). The volume of each fraction was recorded, and the presence of modern contaminants (mainly roots) and/or residual inorganic debris was noted (Appendix 3).

The 4, 2, 1, 0.5-mm fractions were subjected to carpological analysis; the 0.25-mm and <0.25-mm fractions were archived without further analysis. Each analyzed fraction has been fully processed without subsampling. Analyses were conducted using a stereomicroscope (AMScope Stereo Zoom, 3.5X to 90X magnification range). The 4- and 2-mm fractions were fully sorted – i.e., all the specimens present in the fraction were attributed to one of the following categories: (*i*) modern contaminants and non-botanic remains; (*ii*) wood charcoal; (*iii*) seed and fruit; (*iv*) other plant parts; and (*v*) amorphous material. The wood charcoal present in the >4mm fraction was submitted to anthracological analysis (Chapter 5). From the 4, 2, and 1-mm fractions, both entire and fragmented seed/fruit remains were collected and analyzed. In the 0.5-mm fraction only entire seeds were considered.

Botanical identifications are based on a modern reference collection created by the author as part of the dissertation project and housed at New York University, on carpological atlases (e.g., Anderberg 1994, Berggren 1969 and 1981, Bojnanský and Fargasová 2007, Cappers et al. 2012, Jacomet 2006, Neef et al. 2012, Nesbitt 2006, Renfrew 1973), and on illustrated paleoethnobotanical reports from western Asia (e.g., van Zeist and Bakker-Heeres 1982, 1984a, 1984b, and van Zeist et al. 1984). The comparative modern collection of Naomi F. Miller, housed at the University of Pennsylvania Museum of Archaeology and Anthropology, was an additional critical resource used for identification purposes, which has been kindly made available to the author. Identification criteria and phytogeographic assumptions are outlined in Appendix 6. Wild and weed taxonomy follows the *Flora of Turkey* (Davis 1966-1985). Economic plant taxonomy is based on Renfrew (1973) and Jacomet (2006). If needed, identifications were annotated following common practice in archaeobotany: (*i*) "cf." indicates that a specimen is attributed to a taxon, although not all diagnostic characters are visible and/or present; (*ii*) “type” indicates that the specimen matches a taxon yet other taxa cannot be excluded, either because of similar anatomy or because of the lack of accessible comparative materials; (*iii*) “unknown” refers the specimens that cannot be identified, despite preserving anatomic features; and (*iv*) “indeterminate” indicates that no diagnostic characters are visible on the specimen.

6.2.4 *Plant parts counting and recording*

Quantification is based on weight and/or count values (Table 6.2). Economic plants were quantified by count and weight. Weight was recorded separately for entire and fragmented specimens. In the case of cereals, specimens conserving the embryo were considered as whole. For pulses, to each cotyledon was assigned a count value of 0.5. Fruit and nut remains preserving more than the 50% of the whole are counted as 1. Rachis fragments are counted based on the number of preserved nodes. Monocotyledon culm fragments are quantified as weight. Wild and weed taxa are only counted – in the 4, 2, 1-mm fraction are counted the specimens that preserve more than the 50% of the seed/fruit, while in the 0.5-mm fraction only entire specimens are taken into consideration. In the 4 and 2-mm fraction wood charcoal and amorphous fragments are sorted and weighted separately.

	4-mm	2-mm	1-mm	0.5-mm	0.25-mm	<0.25-mm
Wood charcoal	weight	weight				
Cereal (no embryo)	weight	weight	weight			
Cereal (embryo)	weight|count	weight|count	weight|count	weight|count		
Whole economic seeds	weight|count	weight|count	weight|count	weight|count		
Partial economic seeds	weight	weight	weight			
Whole wild/weedy seeds	count	count	count	count		
Partial wild/weedy seeds	count	count	count			
Countable plant parts	count	count	count	count		
Uncountable plant parts	weight	weight	weight	weight		

Table 6.2 – *Screening and counting/weighting protocol*

In addition to taxonomic data, morphometric measurements were recorded for entire cereals grains (genera *Hordeum*, *Triticum*, and *Secale*), *Triticum* rachis segments, and *Vitis vinifera* seeds. Cereals were measured following reference points provided by Jacomet (2006) (Figure 6.2, a-b), while *Vitis vinifera* seeds were measured following Mangafa and Kotsakis (1996) (Figure 6.2, c).

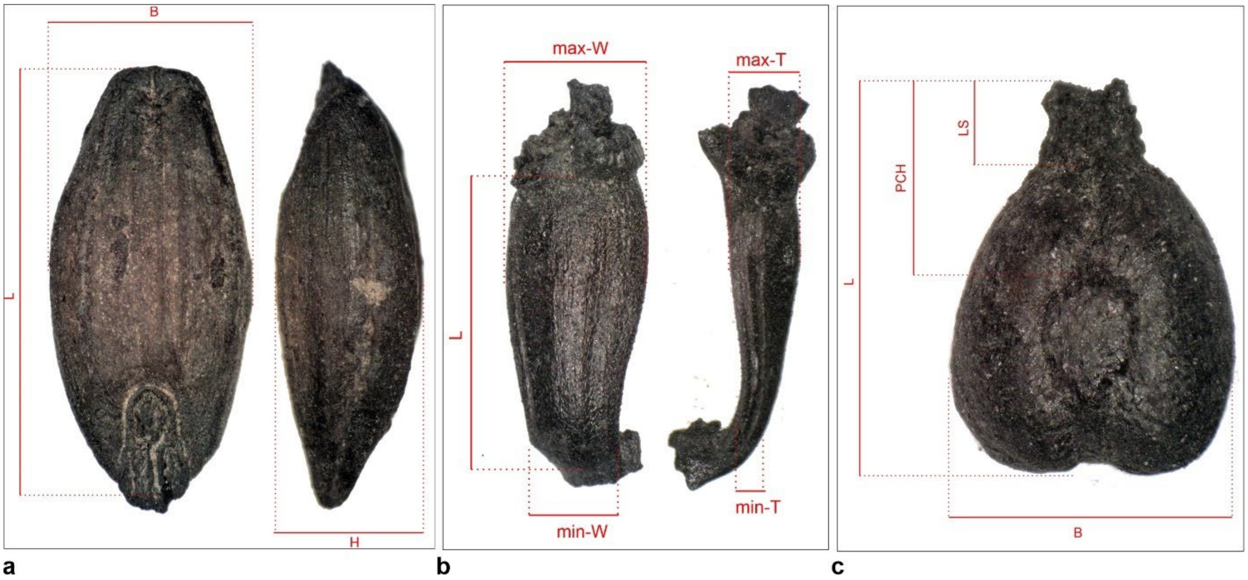

Figure 6.2 – *measurement points used for cereal grains (a), cereal chaff (b), and grape seeds (c).*

6.2.5 *Quantification and elaborations*

The following routine quantification statistics, of common application in archaeobotany (Marston 2014), were used to evaluate the contribution of each taxon to a specific occupation period/context/sample: (*i*) row counts, the absolute number of specimens attributed to a taxon in a specific period/context/sample; (*ii*) concentrations (10 liters), absolute counts divided by the volume of floated sediment from a specific period/context/sample; (*iii*) relative abundance, resulting from dividing the raw count of a specific taxon by the total number of specimens identified in the period/context/sample; and (*iv*) ubiquity, representing the number of samples in which a taxon is found. In addition to the aforementioned statistics, quantitative analyses were based on relative ratios, which allow to standardize a value of interest based on a second variable (Miller 1988). In this chapter, the following ratios were calculated: (*i*) free-threshing wheat (count) to barley (count), applied on both caryopsis and rachis fragments; (*ii*) pulses (count) to cereals (count); and (*iii*) wild and weed taxa (count) to wood charcoal >2 mm (weight) ratio.

The carpological results were subjected to multivariate analysis, which was aimed at further illuminating the main patterns and trends present in the sequence. In order to minimize the impact of sample size differences, the computation was conducted on concentration values, standardized to a 10-liter sample. Economic and wild-weed taxa (including unknowns) were processed separately. Following Legendre and Birks (2012), to decide whether to employ a linear or unimodal ordination method, the length of the gradient was estimated using a Detrended Correspondence Analysis (see Section 5.2.3). A DCA on the concentration data matrix returned a gradient of 2.9 standard deviation units (SD) for economic taxa and 3.2 SD for wild and weed taxa, thus warranting the use of both linear and unimodal methods. Following testing, unimodal methods were favored based on a better performance. Correspondence Analysis (CA) was applied to the economic taxa dataset. Due to the presence of a strong arc-effect in a preliminary CA applied to the wild and weed dataset, for the latter it was opted to apply a Detrended Correspondence Analysis (DCA).

Prior to multivariate analysis, data were standardized and harmonized. In the economic plant dataset, identification to taxa lower than the species level were removed (e.g., Cerealia undifferentiated, *Triticum* sp., *Panicum*/*Setaria*). Taxa were, furthermore, amalgamated: *H. vulgare* var. *nudum* grains were added to the general count of *H. vulgare*; barley rachis fragments were indistinctively regarded as *Hordeum vulgare*; free-threshing wheat rachis fragments were considered as *Triticum aestivum/durum*, regardless of the level of the identification. For wild and weed taxa, the minimum identification threshold was considered at the family level. Unknowns attributed to a specific type were included in the elaboration. Tentative identifications (*cf.*) were amalgamated with positive identifications if the latter were recorded in the dataset. The presence of nutshell and endocarp fragments – which are only sporadically attested and occur in low concentrations in the dataset – was quantified with the count value of 1.

To limit redundancy and noise, samples with less than 15 countable economic plant parts were removed from the economic dataset. The same procedure was applied for the wild and weed dataset. Furthermore, taxa present in less than 3 samples were removed from the economic plant datasets, while a more rigid threshold (ubiquity >10%) was used for wild and weed taxa. Single outliers were manually detected and removed (samples KIN15B2091s57, KIN17A1894s157, and KIN17A1894s158 in the economic dataset; sample KIN16A1711s67 in the wild and weed dataset). Multivariate analysis was conducted in R 3.5.1, package Vegan (version 2.5.5) (Oksanen et al. 2019).

6.3 Results: overview of the carpological assemblage from Niğde-Kınık Höyük

Following the methodology outlined in Section 6.2, more than 51000 countable non-wood plant parts from 174 samples were analyzed, resulting in the identification of more than 178 taxa, attributable to 40 botanical families. The identified carpological flora is listed in Table 6.3. Anatomic characteristics, diagnostic criteria, and candidate species in the Turkish vegetation are provided in Appendix 6.

Economic Taxa			Lepidium perfoliatum	Pinaceae	*Abies* sp.
2-row barley	*Hordeum vulgare* – distichon		Neslia paniculata	Plantaginaceae	*Plantago* sp.
6-row barley	*Hordeum vulgare* – hexastichon	Caryophyllaceae	Caryophillaceae s.l.	Poaceae	Poaceae s.l.
Naked barley	*Hordeum vulgare* var. *nudum*		*Buffonia* sp.		*Aegilops* sp.
Bread wheat	*Triticum aestivum*		*Silene* sp.		*Bromus* sp.
Macaroni wheat	*Triticum durum*		*Gypsophila* sp.		*Eremopyrum* sp.
Einkorn	*Triticum monococcum*		*Vaccaria pyramidata*		*Festuca*- type
Emmer	*Triticum dicoccum*	Chenopodiaceae	*Chenopodiaceae s.l.*		*Hordeum* sp.
Rye	*Secale cereale*		*Atriplex* sp.		*Lolium* sp.
Broomcorn millet	*Panicum miliaceum*		*Beta* sp.		*Micropyrum* -type
Foxtail millet	*Setaria italica*		*Chenopodium murale*- type		*Phalaris* sp.
Chickpea	*Cicer arietinum*		*Chenopodium* sp.		*Poa bulbosa*
Lentil	*Lens culinaris*		*Salsola* sp.		*Setaria viridis* /*verticillata* -type
Common pea	*Pisum sativum*		*Suaeda* sp.		*Stipa* sp.
Broad bean	*Vicia faba*	Cistaceae	*Helianthemum* sp.		*Taeniatherum caput-medusae*
Bitter vetch	*Vicia ervilia*	Convolvulaceae	*Convolvulus* sp.	Polygonaceae	*Polygonaceae s.l.*
Hawthorn	*Crataegus* sp.	Cupressaceae	*Juniperus* sp.		*Persicaria* -type
Russian olive	*Elaeagnus angustifolia*	Cyperaceae	*Cyperaceae s.l.*		*Polygonum* sp.
Common fig	*Ficus carica*		*Bolboschoenus glaucus*		*Polygonum convolvulus*
Walnut	*Juglans regia*		*Bolboschoenus* sp.		*Polygonum aviculare* s.l.
Apple or pear	*Pyrus* /*Malus*		*Carex* spp. (flattened)		*Rumex* sp.
Plum genus	*Prunus* sp.		*Carex* spp. (trigonous)	Portulacaceae	*Portulaca oleracea*
Oak (tentative)	cf *Quercus* sp.		*Cyperus* sp.	Potamogetonaceae	*Potamogeton* sp.
Brambles	*Rubus* sp.		*Cyperus longus*- type	Primulaceae	*Androsace maxima*
Grape	*Vitis vinifera*		*Eleocharis* sp.-type 1	Ranunculaceae	*Adonis* sp.
Coriander	*Coriandrum sativum*		*Eleocharis* sp.-type 2		*Ceratocephalus falcatus*
Linseed	*Linum usitatissumum*		*Fimbristylis* sp.		*Ranunculus* sp.
Wild and Weedy Taxa			Scirpoides holoschoenus	Resedaceae	*Reseda lutea* -type
Alismataceae	*Alisma* sp.	Dipsacaceae	*Dipsacus* -type	Rosaceae	*Sanguisorba* sp.
Apiaceae	Apiaceae s.l.		*Cephalaria* -type	Rubiaceae	Rubiaceae-type 1
	Apium -type		*Scabiosa* sp.		*Asperula arvensis* /*orientalis*
	Bifora radians	Euphorbiaceae	*Euphorbia falcata*- type		*Asperula* sp.
	Bupleurum -type		*Euphorbia taurinensis* -type		*Galium* sp.
	Torilis sp.	Fabaceae	Fabaceae s.l.	Scrophulariaceae	*Scrophularia* /*Verbascum*
Asteraceae	Asteraceae s.l.		Trifolieae s.l.		Veronica dillenii-type
	Artemisia sp.		*Astragalus*- type		Veronica hederifolia
	Aster-type		*Medicago radiata*		*Veronica polita* -type
	Calendula sp.		*Medicago* sp.		*Veronica triphyllos*
	Carduus nutans-type		*Medicago*- type	Solanaceae	*Solanaceae s.l.*
	Centaurea sp.		*Melilotus*- type		*Hyoschyamus* sp.
	Cichorium sp.		*Trifolium*- type		*Solanum* sp.
	Crepis- type		*Trigonella*- type	Thymelaeaceae	*Thymelaea* sp.
	Onopordum sp.		Coronilla-type	Valerianaceae	*Valerianella coronata*- type
	Scorzonera sp.	Lamiaceae	Lamiaceae s.l.		*Valerianella vesicaria*- type
Boraginaceae	Boraginaceae s.l.		Ajuga chamaepitys	Zygophillaceae	Peganum harmala
	Buglossoides tenuiflora		*Ajuga*- type		
	Buglossoides arv. /*Arnebia dec.*		*Lallemianta* -type		
	Echium sp.		*Menta* sp.		
	Heliotropium sp.		*Nepeta* sp.		
	Onosma sp.		*Stachys*- type		
	Symphytum- type		*Teucrium* -type		
Brassicaceae	Brassicaceae s.l.		*Ziziphora* sp.		
	Alyssum- type	Liliaceae	Liliaceae s.l.		
	Brassica- type		*Allium* -type		
	Camelina-type		*Bellevalia* sp.		
	Cardaria draba		*Ornithogalum* sp.		
	Conringia-type	Malvaceae	*Malva* sp.		
	Descurania-type	Papaveraceae	*Fumaria* sp.		
	Euclidum syriacum		*Glaucium* sp.		
	Lepidium sp.		*Papaver* sp.		

Table 6.3 – T*he identified carpological flora from Niğde-Kınık Höyük. For economic taxa it is reported both the common English and scientific name.*

In the following paragraphs, after a brief discussion of preservation modes (Section 6.3.1), I will present the evidence on economic (Section 6.3.3, Table 6.5) and wild-weed taxa (Section 6.3.4, Table 6.6-13). Sample-by-sample results, including both count and weight data, are provided in Appendix 7.

6.3.1 *Preservation modes of the carpological remains*

The vast majority of the carpological remains extracted from the samples included in this study are charred (Figure 6.3). As expected (Section 2.1.1), charring is thus the dominant preservation mode attested in the sequence, accounting for the 92% of the assemblage (including all countable items).

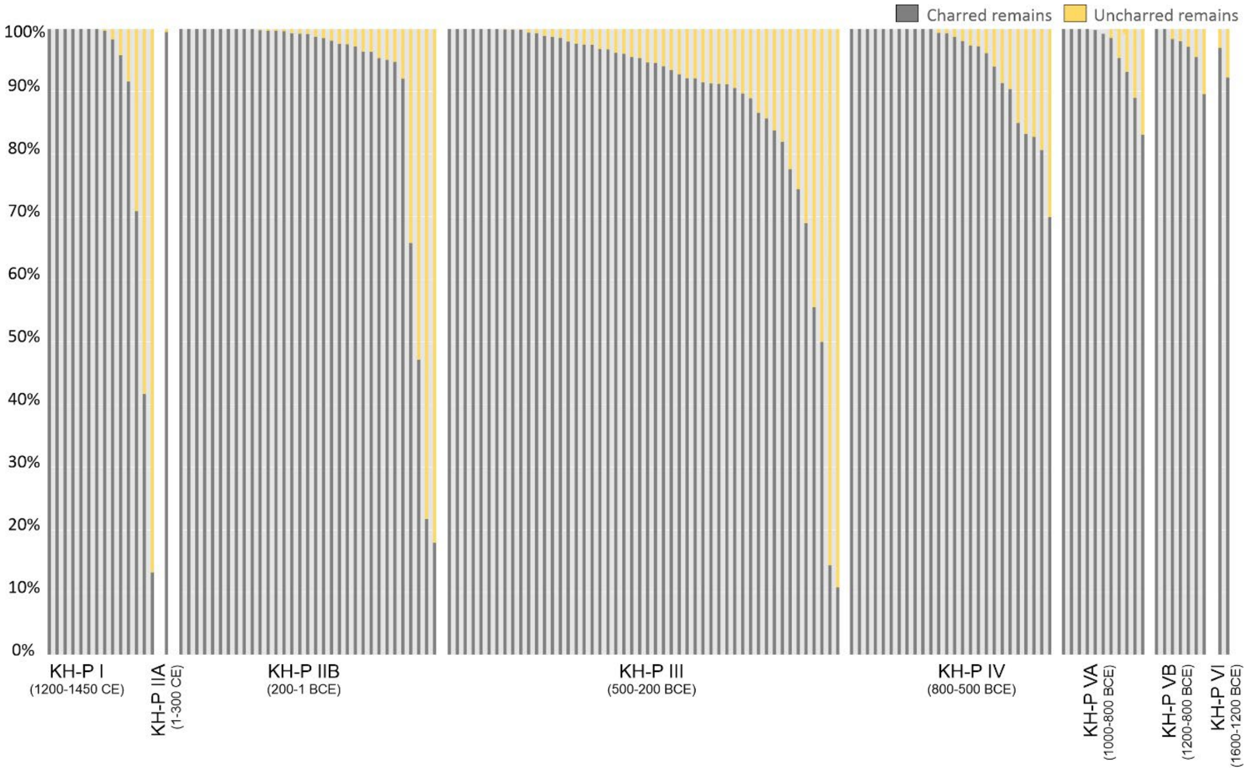

Figure 6.3 – *Bar graph showing the ratio between charred and uncharred carpological remains. Samples containing less than 30 items (including both charred and uncharred) are excluded from the figure. Within each occupation period, samples are ordered based on the percentage of uncharred remains.*

– *Uncharred carpological remains*

Although the large majority of the carpological remains identified in the sampled sequence are charred, uncharred specimens are sporadically attested (Figure 6.3, Table 6.4). In the contexts so far exposed and sampled, the preservation of uncharred remains can be attributable to three main processes: (*i*) mineralization, (*ii*) desiccation, and (*iii*) modern contamination. Based on macroscopic observation, the distinction between these three modes of preservation is not always straightforward, it was thus decided to report indiscriminately these specimens as "uncharred". As discussed in Section 2.1.1, mineralization can occur either because of properties of the embedding sediment or because of the capacity of the plant itself to produce mineral matter, such as carbonate or silica (bio-mineralization; Messager et al. 2010). Uncharred seed/fruit remains of bio-mineralizing plants are regularly found in western Asian sites. Most commonly this preservation occurs for Boraginaceae nutlets and achenes of some members of the Cyperaceae family, taxa that are dominant also in the uncharred assemblage from Kınık Höyük (Table 6.4). As demonstrated by Pustovoytov et al. (2004), the dating of these bio-mineralized remains needs to be evaluated on a case-by-case basis.

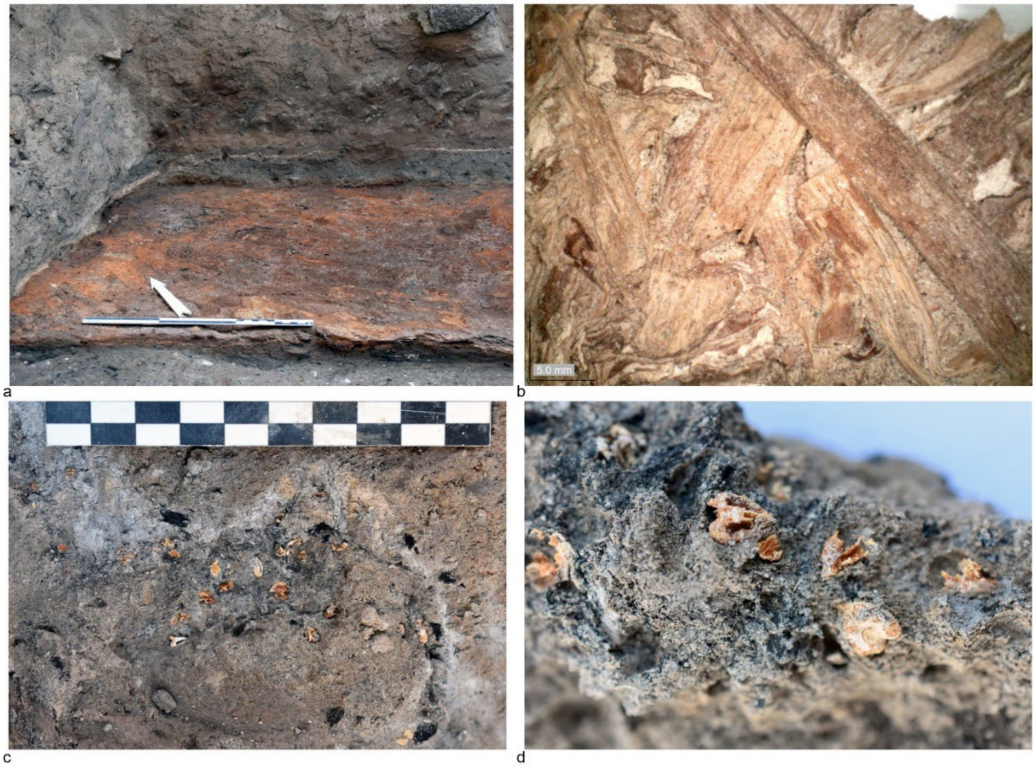

Figure 6.4 – *Examples of in-situ preservation of mineralized plant remains: (a), vegetal plaster (su C2525) found at the bottom of the Silo C2522, in Operation C, Sector C3; (b), detail of the vegetal plaster, stems of monocots are visible; (c), mineralized grape seeds found in Operation B; (d), detail of c.*

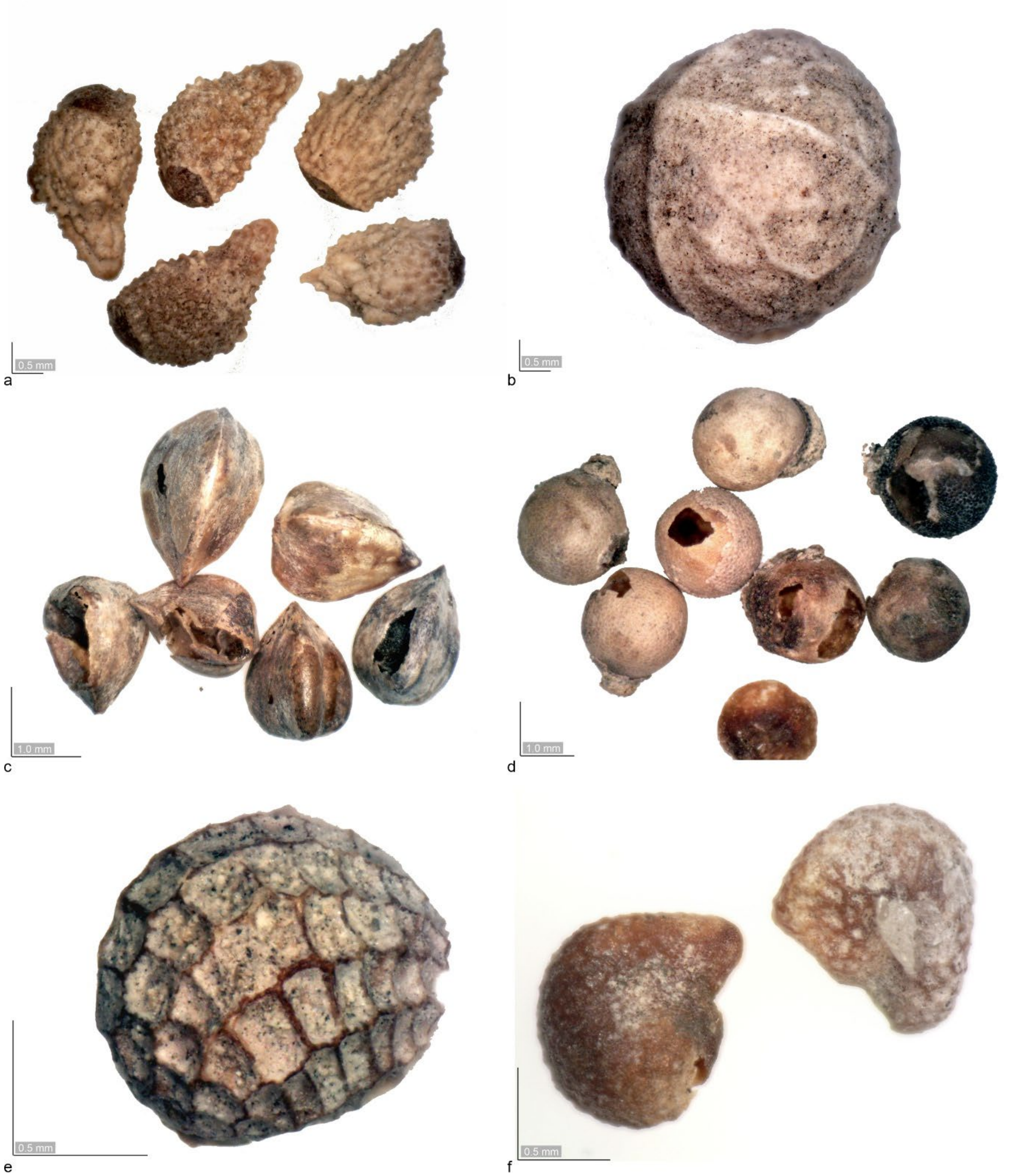

Figure 6.5 – *Examples of uncharred carpological remains:* (*a*), Buglossoides arvensis/Arnebia decumbens (*KIN15C2520s11*); (*b*), Celtis *sp.* (*KIN18C3411s49*); (*c*), Rumex *sp.* (*KIN18C3411s49*); (*d*), Vaccaria pyramidata (*KIN15C2520s11*); (*e*), Glaucium *sp.* (*KIN15C2520s11*); (*f*), Hyoscyamus *sp.* (*KIN15C2520s11*).

(Next page) Table 6.4 – *Uncharred remains: sum = absolute count; max = maximum count value in a single sample; %ub = ubiquity (percentage of samples in which the taxon is found).*

			KH-P I$_{\text{sum}}$	KH-P I$_{\text{max}}$	KH-P I$_{\text{ub\%}}$	KH-P IIA$_{\text{sum}}$	KH-P IIA$_{\text{max}}$	KH-P IIA$_{\text{ub\%}}$	KH-P IIB$_{\text{sum}}$	KH-P IIB$_{\text{max}}$	KH-P IIB$_{\text{ub\%}}$	KH-P III$_{\text{sum}}$	KH-P III$_{\text{max}}$	KH-P III$_{\text{ub\%}}$
		Samples	25	25	25	2	2	2	39	39	39	56	56	56
		Volume (l)	248	248	248	19	19	19	385.7	385.7	385.7	667.2	667.2	667.2
Alismataceae	*Alisma* -type	seed	—	—	—	—	—	—	25	24	5.13	127	67	16.07
Asteraceae	*Chondrilla juncea*	achene	—	—	—	—	—	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	—	—	—	—	—	—	—	—	—	1	1	1.79
	Buglossoides arv. /*Arnebia dec.*	nutlet	3	1	12.00	—	—	—	19	5	17.95	289	69	57.14
	Echium sp.	nutlet	630	626	16.00	—	—	—	148	145	10.26	1177	796	23.21
	Heliotropium sp.	nutlet	—	—	—	—	—	—	—	—	—	1	1	1.79
	Onosma sp.	nutlet	—	—	—	—	—	—	3	3	2.56	4	2	5.36
Brassicaceae	*Alyssum* sp.	seed	—	—	—	—	—	—	—	—	—	2	2	1.79
	Brassicaceae s.l.	seed	—	—	—	—	—	—	—	—	—	—	—	—
	Lepidium perfoliatum	seed	—	—	—	—	—	—	3	2	5.13	1	1	1.79
Caryophyllaceae	*Gypsophila* sp.	seed	—	—	—	—	—	—	—	—	—	—	—	—
	Holosteum umbellatum	seed	—	—	—	—	—	—	1	1	2.56	—	—	—
	Silene sp.	seed	1	1	4.00	—	—	—	—	—	—	—	—	—
	Vaccaria pyramidata	seed	—	—	—	—	—	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	seed	—	—	—	—	—	—	1	1	2.56	1	1	1.79
	Chenopodium sp.	seed	1	1	4.00	—	—	—	—	—	—	1	1	1.79
	Suaeda sp.	seed	—	—	—	—	—	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	seed	—	—	—	—	—	—	1	1	2.56	—	—	—
Cyperaceae	*Carex* sp.	achene	—	—	—	—	—	—	1	1	2.56	9	6	7.14
	Cyperaceae s.l.	achene	11	10	8.00	—	—	—	894	554	33.33	450	84	66.07
	Fimbristylis sp.	achene	1	1	4.00	—	—	—	17	9	12.82	69	34	17.86
Fabaceae	*Onobrychis* sp.	seed and pod	—	—	—	—	—	—	—	—	—	1	1	1.79
	Trifolieae s.l.	seed	2	2	4.00	—	—	—	—	—	—	1	1	1.79
	Trigonella type	seed	—	—	—	—	—	—	—	—	—	1	1	1.79
Malvaceae	*Malva* sp.	seed	—	—	—	—	—	—	—	—	—	3	3	1.79
	Ficus sp.	seed	—	—	—	—	—	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	seed	1	1	4.00	—	—	—	2	1	5.13	182	163	17.86
	Papaver sp.	seed	—	—	—	—	—	—	2	1	5.13	3	2	3.57
Plantaginaceae	*Plantago* sp.	seed	—	—	—	—	—	—	—	—	—	1	1	1.79
Polygonaceae	Polygonaceae s.l.	achene	—	—	—	—	—	—	1	1	2.56	—	—	—
	Rumex sp.	achene	—	—	—	—	—	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	fruit	—	—	—	—	—	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	seed	—	—	—	—	—	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	seed	—	—	—	—	—	—	1	1	2.56	1	1	1.79
Ulmaceae	*Celtis* sp.	endocarp	—	—	—	—	—	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	seed	2	2	4.00	1	1	50.00	2	2	2.56	3	1	5.36
Zygophillaceae	*Peganum harmala*	seed	598	398	12.00	—	—	—	—	—	—	—	—	—
	Tribulus terrestris	fruit	—	—	—	—	—	—	—	—	—	1	1	1.79
unknown	unknown	—	—	—	—	—	—	—	9	9	2.56	13	13	1.79
		Total Charred	4109	1526	96.00	210	203	100.00	13927	3341	100.00	24669	3695	98.21
		Total Uncharred	1250	627	36.00	1	1	50.00	1130	558	64.10	2342	834	82.14

			KH-P IV$_{sum}$	KH-P IV$_{max}$	KH-P IV$_{ub\%}$	KH-P VA$_{sum}$	KH-P VA$_{max}$	KH-P VA$_{ub\%}$	KH-P VB$_{sum}$	KH-P VB$_{max}$	KH-P VB$_{ub\%}$	KH-P VI$_{sum}$	KH-P VI$_{max}$	KH-P VI$_{ub\%}$
		Samples	31	31	31	10	10	10	9	9	9	2	2	2
		Volume (l)	547.7	547.7	547.7	195.6	195.6	195.6	203	203	203	26	26	26
Alismataceae	*Alisma* -type	seed	10	3	22.58	—	—	—	3	1	33.33	—	—	—
Asteraceae	*Chondrilla juncea*	achene	—	—	—	1	1	10.00	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	—	—	—	—	—	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	nutlet	69	19	32.26	14	8	40.00	9	4	55.56	2	1	100.00
	Echium sp.	nutlet	1	1	3.23	—	—	—	—	—	—	—	—	—
	Heliotropium sp.	nutlet	—	—	—	—	—	—	—	—	—	—	—	—
	Onosma sp.	nutlet	—	—	—	—	—	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	seed	—	—	—	1	1	10.00	—	—	—	—	—	—
	Brassicaceae s.l.	seed	7	6	6.45	2	1	20.00	—	—	—	—	—	—
	Lepidium perfoliatum	seed	1	1	3.23	8	8	10.00	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	seed	7	7	3.23	—	—	—	—	—	—	—	—	—
	Holosteum umbellatum	seed	—	—	—	—	—	—	—	—	—	—	—	—
	Silene sp.	seed	1	1	3.23	—	—	—	—	—	—	—	—	—
	Vaccaria pyramidata	seed	22	16	16.13	2	2	10.00	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	seed	5	2	12.90	—	—	—	1	1	11.11	1	1	50.00
	Chenopodium sp.	seed	2	2	3.23	15	14	20.00	—	—	—	—	—	—
	Suaeda sp.	seed	3	2	6.45	—	—	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	seed	—	—	—	—	—	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	achene	7	4	9.68	—	—	—	22	15	33.33	—	—	—
	Cyperaceae s.l.	achene	26	12	32.26	3	1	30.00	3	2	22.22	2	1	100.00
	Fimbristylis sp.	achene	—	—	—	—	—	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	seed and pod	—	—	—	—	—	—	—	—	—	—	—	—
	Trifolieae s.l.	seed	—	—	—	—	—	—	—	—	—	—	—	—
	Trigonella type	seed	—	—	—	—	—	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	seed	—	—	—	—	—	—	—	—	—	—	—	—
	Ficus sp.	seed	—	—	—	—	—	—	2	2	11.11	—	—	—
Papaveraceae	*Glaucium* sp.	seed	3	2	6.45	—	—	—	—	—	—	—	—	—
	Papaver sp.	seed	—	—	—	—	—	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	seed	—	—	—	—	—	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	achene	2	1	6.45	—	—	—	—	—	—	—	—	—
	Rumex sp.	achene	8	6	9.68	—	—	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	fruit	1	1	3.23	—	—	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	seed	—	—	—	—	—	—	1	1	11.11	—	—	—
Solanaceae	*Hyoscyamus* sp.	seed	2	2	3.23	—	—	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	endocarp	—	—	—	—	—	—	—	—	—	3	3	50.00
Vitaceae	*Vitis vinifera*	seed	1	1	3.23	—	—	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	seed	—	—	—	—	—	—	—	—	—	—	—	—
	Tribulus terrestris	fruit	3	2	6.45	—	—	—	1	1	11.11	1	1	50.00
unknown	unknown	—	5	5	3.23	—	—	—	4	4	11.11	1	1	50.00
		Total Charred	11887	4946	93.55	1533	549	100.00	962	233	88.89	159	95	100.00
		Total Uncharred	186	70	54.84	46	25	70.00	46	27	55.56	10	8	100.00

6.3.2 *Charred remains: an overview of the assemblage*

More than 45,900 countable charred plant parts have been analyzed, which correspond in the entire sampled sequence to a concentration of 201 items/10-liters. Considering the cumulative values calculated for each occupation period, the highest concentration is documented during Period KH-P III (341 items/10-l sample), while the lowest is attested in Period KH-P VB (43 items/10-l sample). The assemblage is dominated by wild and weed taxa (Figure 6.6), which account for the 85% (including unknowns) of the identified seed/fruit remains. Economic and wild/weed taxa will be discussed respectively in Section 6.3.3 and Section 6.3.4.

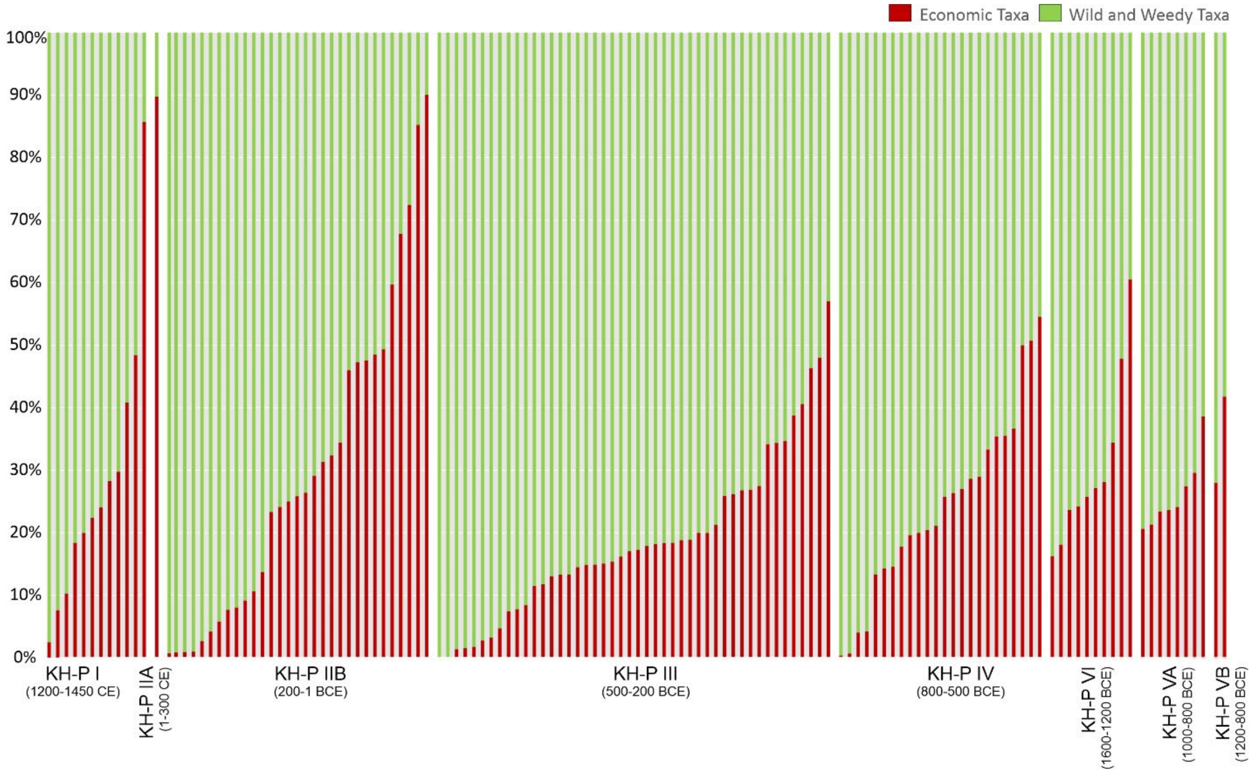

Figure 6.6 – *Bar graph showing the ratio between economic and wild-weedy-unknown taxa. Samples containing less than 30 countable items are excluded from the figure. Within each occupation period, samples are ordered based on the percentage of economic plant parts.*

In addition to seed/fruit remains, wood charcoal larger than 2-mm and amorphous material larger than 1-mm were sorted and quantified (Appendix 7). To the latter category are attributed fragments of charred organic substance without any diagnostic anatomic feature. These specimens could represent highly degraded wood charcoal, parenchyma, charred dung, food remains, or any other organic mixture. An ad-hoc study at the SEM (e.g., González Carretero et al. 2017), which is not included in the dissertation, is needed in order to properly defining and classify this heterogeneous material.

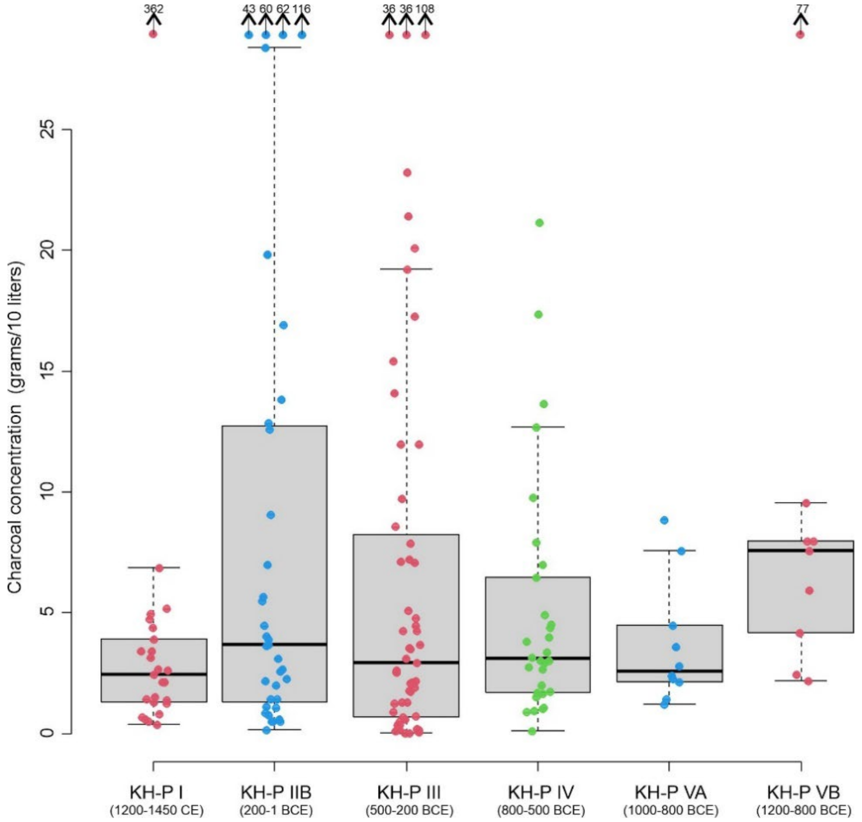

Figure 6.7 – *Box plot showing charcoal concentration (grams charcoal >2 mm/ 10-l). Each dot represents a sample. Values exceeding the Y axis are reported on top of the graph.*

Wood charcoal (>2 mm) concentrations (10-liters) are provided in Figure 6.7. With the sole exception of the poorly sampled period KH-P VB (1200-1000 BCE), median charcoal concentrations are relatively stable throughout the sequence, while a generalized increase in charred-rich samples is recorded during period KH-P III and IIB. The presence of a marked sample-specific variability is expected, considering the differences in the depositional contexts covered by sampling (Table 6.1).

6.3.3 *Economic taxa*

With the term 'Economic taxa', I refer to botanical remains originating from plants of recognized economic importance in Anatolia – in other words, taxa that are known or expected to have been exploited for a specific reason by human groups settled in the region (Neef et al. 2012: ix). Taxa included in this category can be either attributed to cultivated or wild plants – the latter having a well-known importance in traditional Anatolian rural economies (e.g., Ertuğ 2000). To facilitate presentation, economic taxa will be divided into five main groups: (*i*) cereals, including both grains and rachis; (*ii*) pulses, referring to cultivated crops of the Fabaceae family; (*iii*) fruits and nuts, which includes both wild and cultivated taxa which fleshy fruits or edible nuts are known/expected to be consumed; and finally (*iv*) oil seeds and herbs, including all taxa known to be used for such purposes.

In the sampled sequence, a total of 6,824 countable plant parts attributable to economic taxa were identified, belonging to 25 taxa, and attributed to 9 botanical families (Table 6.3). Maximum floristic diversity is recorded during period KH-P IIB (200-1 BCE; 20 taxa), while the lowest diversity is attested in period KH-P VB (1200-1000 BCE, 7 taxa).[31] Summary results for each occupation period are provided in Tables 6.5-12. Relative abundance graphs are presented in Figures 6.8 (samples) and 6.9 (aggregate values for periods). Sample-by-sample data are provided in Appendix 7.

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[31] Period KH-P VA and KH-P VI are not included in this statistic, due to the limited number of samples available.

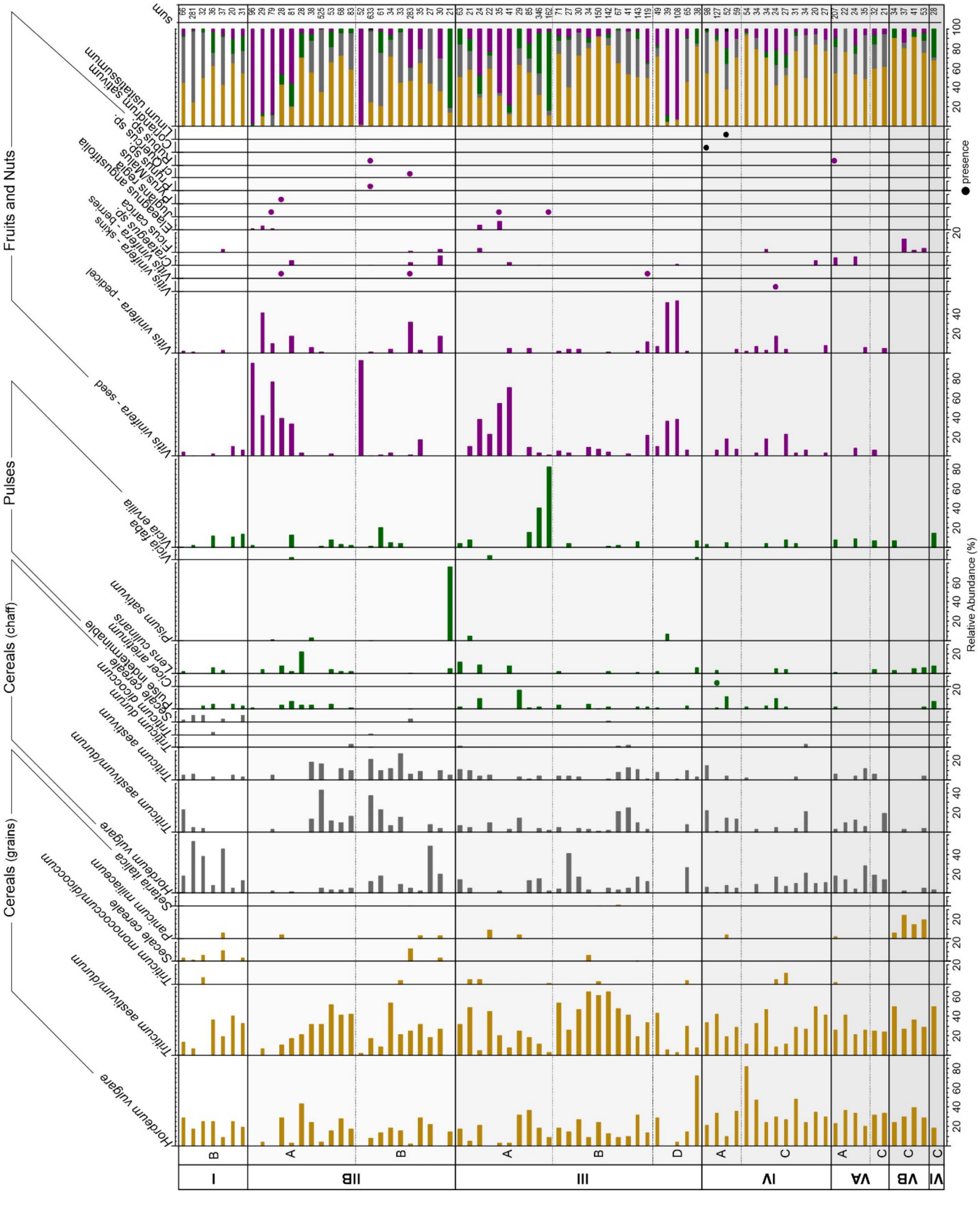

Figure 6.8 – *Relative abundances of economic taxa. The graph is based on relative abundance, calculated using the total of economic plant parts as sum. Samples with less than 20 economic plant parts (including rachis and pedicels) are excluded from the figure. In the case of nutshells and stones, presence is considered with the count value of 1. Sample-by-sample tabular data are available in* Appendix 7.

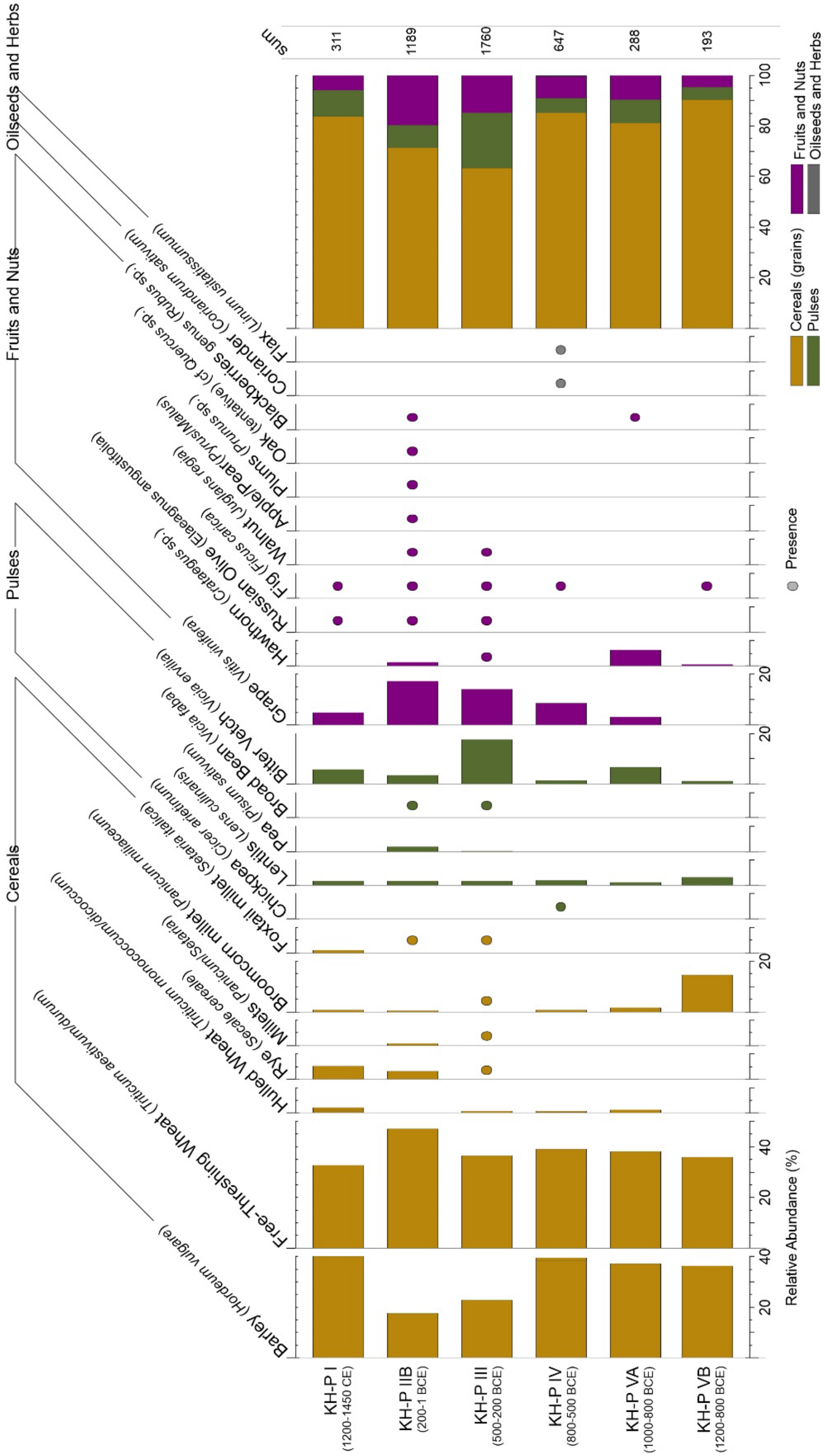

Figure 6.9 – *Relative abundance of economic taxa calculated for each occupation period. Rachis, chaff, and pedicels are not included in the sum. Tabular data are available in Table 6.5 to 6.12*

			KH-P I$_{sum}$	KH-P I$_{max}$	KH-P I$_{con-10l}$	KH-P I$_{ub\%}$
		Samples | Volume (l)	25 | 248	25 | 248	25 | 248	25 | 248
Cereal grains						
Cereals undif.	Cerealia	caryopsis	P	P	P	84.00
Cereals undif.	Cerealia	germ	11	4	0.44	28.00
Barley	*Hordeum vulgare*	caryopsis	124	47	5.00	84.00
Naked barley	*Hordeum vulgare* var. *nudum*	caryopsis	—	—	—	—
Wheat undif.	*Triticum* sp.	caryopsis	6	4	0.24	16.00
Free-threshing wheat	*Triticum aestivum* /*durum*	caryopsis	102	19	4.11	80.00
Einkorn or Emmer	*Triticum monococcum* /*dicoccum*	caryopsis	2	2	0.08	4.00
Einkorn	*Triticum monococcum*	caryopsis	2	1	0.08	8.00
Emmer	*Triticum dicoccum*	caryopsis	3	2	0.12	8.00
Rye	*Secale cereale*	caryopsis	16	4	0.65	32.00
Rye or Wheat	*Triticum* /*Secale*	caryopsis	—	—	—	—
Millet undif.	*Panicum* /*Setaria*	caryopsis	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	caryopsis	2	2	0.08	4.00
Foxtail millet	*Setaria italica*	caryopsis	3	2	0.12	8.00
Cereal chaff						
Monocots	Culm fragments (weight)	culm	0.515	0.218	0.02	56.00
Cereals undif.	Cerealia	rachis segment frg	6	6	0.24	4.00
Cereals undif.	Cerealia	rachis basal segment	2	2	0.08	4.00
Cereals undif.	Cerealia	glume	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	rachis segment frg	8	2	0.32	28.00
2-row barley	*Hordeum vulgare* – distichon	rachis segment frg	201	150	8.10	48.00
6-row barley	*Hordeum vulgare* – hexastichon	rachis segment frg	1	1	0.04	4.00
Wheat	*Triticum* sp.	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis node	24	12	0.97	32.00
Free-threshing wheat	Triticum aestivum/durum	rachis segment frg	5	3	0.20	8.00
Free-threshing wheat	Triticum aestivum/durum	rachis segment	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis basal segment	8	7	0.32	8.00
Bread wheat	Triticum aestivum	rachis segment frg	20	13	0.81	24.00
Bread wheat	Triticum aestivum	rachis segment	3	3	0.12	4.00
Macaroni wheat	*Triticum durum*	rachis segment	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	rachis segment	—	—	—	—
Emmer	*Triticum dicoccum*	spikelet fork	1	1	0.04	4.00
Emmer (tentative)	*Triticum* cf *dicoccum*	glume base	—	—	—	—
Rye	*Secale cereale*	rachis segment frg	26	19	1.05	24.00
Pulses						
Pulse undif.	Pulse indeterminable	seed	10	3	0.40	32.00
Chickpea	*Cicer arietinum*	seed	—	—	—	—
Lentil	*Lens culinaris*	seed	5	2	0.20	16.00
Common pea	*Pisum sativum*	seed	—	—	—	—
Broad bean	*Vicia faba*	seed	—	—	—	—
Bitter vetch	*Vicia ervilia*	seed	17.5	4.5	0.71	28.00
Vetch/field pea	*Vicia* /*Lathyrus*	seed	—	—	—	—
Fruits and Nuts						
Hawthorn	*Crataegus* sp.	pyrene	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	endocarp	1	1	0.04	4.00
Common fig	*Ficus carica*	seed	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	seed	2	1	0.08	8.00
Walnut	*Juglans regia*	endocarp	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	endocarp	—	—	—	—
Apple or pear	*Pyrus* /*Malus*	seed	—	—	—	—
Plum genus	*Prunus* sp.	seed	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	cupule	—	—	—	—
Brambles	*Rubus* sp.	seed	—	—	—	—
Grape	*Vitis vinifera*	seed	15	3	0.60	52.00
Grape	*Vitis vinifera*	pedicel	3	1	0.12	12.00
Grape	*Vitis vinifera (weight)*	skin fragment	—	—	—	—
Grape	*Vitis vinifera*	berry	—	—	—	—
Grape	*Vitis vinifera*	tendril	—	—	—	—
Herbs and oilseeds						
Coriander	*Coriandrum sativum*	schizocarp	—	—	—	—
Linseed	*Linum usitatissumum*	seed	—	—	—	—

Table 6.5 – *KH-P I Economic taxa: sum = absolute count; max = maximum count value in a single sample; con-10l% = concentration expressed with a standard value of 10 liters; ub = ubiquity (percentage of samples in which the taxon is found).*

			KH-P IIA$_{sum}$	KH-P IIA$_{max}$	KH-P IIA$_{con-10l}$	KH-P IIA$_{ub\%}$
		Samples | Volume (l)	2 | 19	2 | 19	2 | 19	2 | 19
Cereal grains						
Cereals undif.	Cerealia	caryopsis	P	P	P	100.00
Cereals undif.	Cerealia	germ	—	—	—	—
Barley	*Hordeum vulgare*	caryopsis	2	1	1.05	100.00
Naked barley	*Hordeum vulgare* var. *nudum*	caryopsis	—	—	—	—
Wheat undif.	*Triticum* sp.	caryopsis	—	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	caryopsis	2	2	1.05	50.00
Einkorn or Emmer	*Triticum monococcum /dicoccum*	caryopsis	—	—	—	—
Einkorn	*Triticum monococcum*	caryopsis	—	—	—	—
Emmer	*Triticum dicoccum*	caryopsis	—	—	—	—
Rye	*Secale cereale*	caryopsis	—	—	—	—
Rye or Wheat	*Triticum /Secale*	caryopsis	—	—	—	—
Millet undif.	*Panicum /Setaria*	caryopsis	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	caryopsis	—	—	—	—
Foxtail millet	*Setaria italica*	caryopsis	—	—	—	—
Cereal chaff						
Monocots	Culm fragments (weight)	culm	—	—	—	—
Cereals undif.	Cerealia	rachis segment frg	—	—	—	—
Cereals undif.	Cerealia	rachis basal segment	—	—	—	—
Cereals undif.	Cerealia	glume	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	rachis segment frg	—	—	—	—
2-row barley	*Hordeum vulgare* – distichon	rachis segment frg	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	rachis segment frg	—	—	—	—
Wheat	*Triticum* sp.	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis node	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis segment	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis basal segment	—	—	—	—
Bread wheat	Triticum aestivum	rachis segment frg	—	—	—	—
Bread wheat	Triticum aestivum	rachis segment	—	—	—	—
Macaroni wheat	*Triticum durum*	rachis segment	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	rachis segment	—	—	—	—
Emmer	*Triticum dicoccum*	spikelet fork	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	glume base	—	—	—	—
Rye	*Secale cereale*	rachis segment frg	—	—	—	—
Pulses						
Pulse undif.	Pulse indeterminable	seed	1	1	0.53	50.00
Chickpea	*Cicer arietinum*	seed	—	—	—	—
Lentil	*Lens culinaris*	seed	—	—	—	—
Common pea	*Pisum sativum*	seed	—	—	—	—
Broad bean	*Vicia faba*	seed	—	—	—	—
Bitter vetch	*Vicia ervilia*	seed	1	1	0.53	50.00
Vetch/field pea	*Vicia /Lathyrus*	seed	—	—	—	—
Fruits and Nuts						
Hawthorn	*Crataegus* sp.	pyrene	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	endocarp	1	1	0.53	50.00
Common fig	*Ficus carica*	seed	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	seed	—	—	—	—
Walnut	*Juglans regia*	endocarp	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	endocarp	—	—	—	—
Apple or pear	*Pyrus /Malus*	seed	—	—	—	—
Plum genus	*Prunus* sp.	seed	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	cupule	—	—	—	—
Brambles	*Rubus* sp.	seed	—	—	—	—
Grape	*Vitis vinifera*	seed	92	92	48.42	50.00
Grape	*Vitis vinifera*	pedicel	—	—	—	—
Grape	*Vitis vinifera (weight)*	skin fragment	—	—	—	—
Grape	*Vitis vinifera*	berry	—	—	—	—
Grape	*Vitis vinifera*	tendril	—	—	—	—
Herbs and oilseeds						
Coriander	*Coriandrum sativum*	schizocarp	—	—	—	—
Linseed	*Linum usitatissumum*	seed	—	—	—	—

Table 6.6 – *KH-P IIA Economic taxa: sum = absolute count; max = maximum count value in a single sample; con-10l% = concentration expressed with a standard value of 10 liters; ub = ubiquity (percentage of samples in which the taxon is found).*

			KH-P IIB$_{sum}$	KH-P IIB$_{max}$	KH-P IIB$_{con\text{-}10l}$	KH-P IIB$_{ub\%}$
		Samples | Volume (l)	39 | 385.7	39 | 385.7	39 | 385.7	39 | 385.7
Cereal grains						
Cereals undif.	Cerealia	caryopsis	3	2	0.08	92.31
Cereals undif.	Cerealia	germ	5	1	0.13	12.82
Barley	*Hordeum vulgare*	caryopsis	206	47	5.34	89.74
Naked barley	*Hordeum vulgare* var. *nudum*	caryopsis	2	1	0.05	5.13
Wheat undif.	*Triticum* sp.	caryopsis	18	5	0.47	28.21
Free-threshing wheat	*Triticum aestivum /durum*	caryopsis	559	165	14.49	79.49
Einkorn or Emmer	*Triticum monococcum /dicoccum*	caryopsis	—	—	—	2.56
Einkorn	*Triticum monococcum*	caryopsis	—	—	—	—
Emmer	*Triticum dicoccum*	caryopsis	2	1	0.05	10.26
Rye	*Secale cereale*	caryopsis	38	36	0.99	7.69
Rye or Wheat	*Triticum /Secale*	caryopsis	5	4	0.13	5.13
Millet undif.	*Panicum /Setaria*	caryopsis	9	9	0.23	2.56
Broomcorn millet	*Panicum miliaceum*	caryopsis	4	1	0.10	10.26
Foxtail millet	*Setaria italica*	caryopsis	3	2	0.08	5.13
Cereal chaff						
Monocots	Culm fragments (weight)	culm	1.981	0.598	0.05	58.97
Cereals undif.	Cerealia	rachis segment frg	1	1	0.03	2.56
Cereals undif.	Cerealia	rachis basal segment	3	3	0.08	2.56
Cereals undif.	Cerealia	glume	6	6	0.16	2.56
Barlet undif.	*Hordeum vulgare* – undif.	rachis segment frg	18	8	0.47	17.95
2-row barley	*Hordeum vulgare* – distichon	rachis segment frg	150	67	3.89	33.33
6-row barley	*Hordeum vulgare* – hexastichon	rachis segment frg	6	6	0.16	2.56
Wheat	*Triticum* sp.	rachis segment frg	3	2	0.08	5.13
Free-threshing wheat	Triticum aestivum/durum	rachis node	378	210	9.80	35.90
Free-threshing wheat	Triticum aestivum/durum	rachis segment frg	52	42	1.35	17.95
Free-threshing wheat	Triticum aestivum/durum	rachis segment	1	1	0.03	2.56
Free-threshing wheat	Triticum aestivum/durum	rachis basal segment	91	76	2.36	7.69
Bread wheat	Triticum aestivum	rachis segment frg	282	124	7.31	43.59
Bread wheat	Triticum aestivum	rachis segment	23	13	0.60	17.95
Macaroni wheat	*Triticum durum*	rachis segment	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	rachis segment	8	4	0.21	7.69
Emmer	*Triticum dicoccum*	spikelet fork	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	glume base	1	1	0.03	2.56
Rye	*Secale cereale*	rachis segment frg	8	7	0.21	5.13
Pulses						
Pulse undif.	Pulse indeterminable	seed	19.5	6	0.51	41.03
Chickpea	*Cicer arietinum*	seed	—	—	—	—
Lentil	*Lens culinaris*	seed	18.5	6	0.48	30.77
Common pea	*Pisum sativum*	seed	22	16	0.57	12.82
Broad bean	*Vicia faba*	seed	2	2	0.05	2.56
Bitter vetch	*Vicia ervilia*	seed	40.5	12	1.05	33.33
Vetch/field pea	*Vicia /Lathyrus*	seed	2	2	0.05	2.56
Fruits and Nuts						
Hawthorn	*Crataegus* sp.	pyrene	17	9	0.44	10.26
Russian olive	*Elaeagnus angustifolia*	endocarp	2	1	0.05	5.13
Common fig	*Ficus carica*	seed	3	2	0.08	5.13
Common fig (tentative)	cf *Ficus carica*	seed	—	—	—	—
Walnut	*Juglans regia*	endocarp	2	1	0.05	5.13
Walnut (tentative)	cf *Juglans regia*	endocarp	—	—	—	—
Apple or pear	*Pyrus /Malus*	seed	1	1	0.03	2.56
Plum genus	*Prunus* sp.	seed	1	1	0.03	2.56
Oak (tentative)	cf *Quercus* sp.	cupule	1	1	0.03	2.56
Brambles	*Rubus* sp.	seed	1	1	0.03	2.56
Grape	*Vitis vinifera*	seed	190	60	4.93	64.10
Grape	*Vitis vinifera*	pedicel	140	90	3.63	35.90
Grape	*Vitis vinifera (weight)*	skin fragment	—	—	—	—
Grape	*Vitis vinifera*	berry	4	3	0.10	5.13
Grape	*Vitis vinifera*	tendril	5	5	0.13	2.56
Herbs and oilseeds						
Coriander	*Coriandrum sativum*	schizocarp	—	—	—	—
Linseed	*Linum usitatissumum*	seed	—	—	—	—

Table 6.7 – *KH-P IIB Economic taxa: sum = absolute count; max = maximum count value in a single sample; con-10l% = concentration expressed with a standard value of 10 liters; ub = ubiquity (percentage of samples in which the taxon is found).*

			KH-P III$_{sum}$	KH-P III$_{max}$	KH-P III$_{con-10l}$	KH-P III$_{ub\%}$
		Samples | Volume (l)	56 | 667.2	56 | 667.2	56 | 667.2	56 | 667.2
Cereal grains						
Cereals undif.	Cerealia	caryopsis	1	1	0.01	91.07
Cereals undif.	Cerealia	germ	77	30	1.15	21.43
Barley	*Hordeum vulgare*	caryopsis	401	64	6.01	89.29
Naked barley	*Hordeum vulgare* var. *nudum*	caryopsis	—	—	—	—
Wheat undif.	*Triticum* sp.	caryopsis	42	9	0.63	30.36
Free-threshing wheat	*Triticum aestivum* /*durum*	caryopsis	643	92	9.64	87.50
Einkorn or Emmer	*Triticum monococcum* /*dicoccum*	caryopsis	—	—	—	—
Einkorn	*Triticum monococcum*	caryopsis	—	—	—	—
Emmer	*Triticum dicoccum*	caryopsis	10	3	0.15	12.50
Rye	*Secale cereale*	caryopsis	5	2	0.07	7.14
Rye or Wheat	*Triticum* /*Secale*	caryopsis	3	2	0.04	3.57
Millet undif.	*Panicum* /*Setaria*	caryopsis	2	1	0.03	3.57
Broomcorn millet	*Panicum miliaceum*	caryopsis	4	2	0.06	5.36
Foxtail millet	*Setaria italica*	caryopsis	3	1	0.04	5.36
Cereal chaff						
Monocots	Culm fragments (weight)	culm	1.808	0.711	0.03	55.36
Cereals undif.	Cerealia	rachis segment frg	—	—	—	—
Cereals undif.	Cerealia	rachis basal segment	2	1	0.03	3.57
Cereals undif.	Cerealia	glume	3	3	0.04	1.79
Barlet undif.	*Hordeum vulgare* – undif.	rachis segment frg	46	26	0.69	23.21
2-row barley	*Hordeum vulgare* – distichon	rachis segment frg	128	24	1.92	26.79
6-row barley	*Hordeum vulgare* – hexastichon	rachis segment frg	1	1	0.01	1.79
Wheat	*Triticum* sp.	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis node	67	13	1.00	41.07
Free-threshing wheat	Triticum aestivum/durum	rachis segment frg	9	4	0.13	8.93
Free-threshing wheat	Triticum aestivum/durum	rachis segment	1	1	0.01	1.79
Free-threshing wheat	Triticum aestivum/durum	rachis basal segment	13	5	0.19	8.93
Bread wheat	Triticum aestivum	rachis segment frg	72	14	1.08	35.71
Bread wheat	Triticum aestivum	rachis segment	9	2	0.13	12.50
Macaroni wheat	*Triticum durum*	rachis segment	2	2	0.03	1.79
Macaroni wheat (tentative)	*Triticum* cf *durum*	rachis segment	3	1	0.04	5.36
Emmer	*Triticum dicoccum*	spikelet fork	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	glume base	—	—	—	—
Rye	*Secale cereale*	rachis segment frg	1	1	0.01	1.79
Pulses						
Pulse undif.	Pulse indeterminable	seed	38	5.5	0.57	46.43
Chickpea	*Cicer arietinum*	seed	—	—	—	—
Lentil	*Lens culinaris*	seed	27.5	7	0.41	26.79
Common pea	*Pisum sativum*	seed	4.5	2.5	0.07	5.36
Broad bean	*Vicia faba*	seed	3	1	0.04	5.36
Bitter vetch	*Vicia ervilia*	seed	309	139.5	4.63	32.14
Vetch/field pea	*Vicia* /*Lathyrus*	seed	1	1	0.01	1.79
Fruits and Nuts						
Hawthorn	*Crataegus* sp.	pyrene	3	1	0.04	5.36
Russian olive	*Elaeagnus angustifolia*	endocarp	6	3	0.09	7.14
Common fig	*Ficus carica*	seed	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	seed	1	1	0.01	1.79
Walnut	*Juglans regia*	endocarp	3	1	0.04	5.36
Walnut (tentative)	cf *Juglans regia*	endocarp	1	1	0.01	1.79
Apple or pear	*Pyrus* /*Malus*	seed	—	—	—	—
Plum genus	*Prunus* sp.	seed	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	cupule	—	—	—	—
Brambles	*Rubus* sp.	seed	—	—	—	—
Grape	*Vitis vinifera*	seed	245	41	3.67	69.64
Grape	*Vitis vinifera*	pedicel	114	58	1.71	28.57
Grape	*Vitis vinifera (weight)*	skin fragment	—	—	—	—
Grape	*Vitis vinifera*	berry	1	1	0.01	1.79
Grape	*Vitis vinifera*	tendril	2	2	0.03	1.79
Herbs and oilseeds						
Coriander	*Coriandrum sativum*	schizocarp	—	—	—	—
Linseed	*Linum usitatissumum*	seed	—	—	—	—

Table 6.8 – *KH-P III Economic taxa: sum = absolute count; max = maximum count value in a single sample; con-10l% = concentration expressed with a standard value of 10 liters; ub = ubiquity (percentage of samples in which the taxon is found).*

			KH-P IV$_{sum}$	KH-P IV$_{max}$	KH-P IV$_{con\text{-}10l}$	KH-P IV$_{ub\%}$
		Samples | Volume (l)	31 | 547.7	31 | 547.7	31 | 547.7	31 | 547.7
Cereal grains						
Cereals undif.	Cerealia	caryopsis	1	1	0.02	93.55
Cereals undif.	Cerealia	germ	2	1	0.04	6.45
Barley	*Hordeum vulgare*	caryopsis	248	44	4.53	77.42
Naked barley	*Hordeum vulgare* var. *nudum*	caryopsis	8	8	0.15	3.23
Wheat undif.	*Triticum* sp.	caryopsis	32	16	0.58	41.94
Free-threshing wheat	*Triticum aestivum /durum*	caryopsis	253	53	4.62	87.10
Einkorn or Emmer	*Triticum monococcum /dicoccum*	caryopsis	3	3	0.05	3.23
Einkorn	*Triticum monococcum*	caryopsis	—	—	—	—
Emmer	*Triticum dicoccum*	caryopsis	2	1	0.04	6.45
Rye	*Secale cereale*	caryopsis	—	—	—	—
Rye or Wheat	*Triticum /Secale*	caryopsis	—	—	—	—
Millet undif.	*Panicum /Setaria*	caryopsis	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	caryopsis	4	2	0.07	6.45
Foxtail millet	*Setaria italica*	caryopsis	—	—	—	—
Cereal chaff						
Monocots	Culm fragments (weight)	culm	0.194	0.065	0.00	48.39
Cereals undif.	Cerealia	rachis segment frg	—	—	—	—
Cereals undif.	Cerealia	rachis basal segment	—	—	—	—
Cereals undif.	Cerealia	glume	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	rachis segment frg	25	4	0.46	38.71
2-row barley	*Hordeum vulgare* – distichon	rachis segment frg	21	4	0.38	38.71
6-row barley	*Hordeum vulgare* – hexastichon	rachis segment frg	1	1	0.02	3.23
Wheat	*Triticum* sp.	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis node	34	15	0.62	22.58
Free-threshing wheat	Triticum aestivum/durum	rachis segment frg	13	5	0.24	19.35
Free-threshing wheat	Triticum aestivum/durum	rachis segment	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis basal segment	1	1	0.02	3.23
Bread wheat	Triticum aestivum	rachis segment frg	15	13	0.27	9.68
Bread wheat	Triticum aestivum	rachis segment	5	2	0.09	12.90
Macaroni wheat	*Triticum durum*	rachis segment	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	rachis segment	1	1	0.02	3.23
Emmer	*Triticum dicoccum*	spikelet fork	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	glume base	—	—	—	—
Rye	*Secale cereale*	rachis segment frg	—	—	—	—
Pulses						
Pulse undif.	Pulse indeterminable	seed	16	6.5	0.29	35.48
Chickpea	*Cicer arietinum*	seed	1	1	0.02	3.23
Lentil	*Lens culinaris*	seed	12	7	0.22	12.90
Common pea	*Pisum sativum*	seed	—	—	—	—
Broad bean	*Vicia faba*	seed	—	—	—	—
Bitter vetch	*Vicia ervilia*	seed	9	2	0.16	19.35
Vetch/field pea	*Vicia /Lathyrus*	seed	—	—	—	—
Fruits and Nuts						
Hawthorn	*Crataegus* sp.	pyrene	—	—	—	3.23
Russian olive	*Elaeagnus angustifolia*	endocarp	—	—	—	—
Common fig	*Ficus carica*	seed	1	1	0.02	3.23
Common fig (tentative)	cf *Ficus carica*	seed	—	—	—	—
Walnut	*Juglans regia*	endocarp	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	endocarp	—	—	—	—
Apple or pear	*Pyrus /Malus*	seed	—	—	—	—
Plum genus	*Prunus* sp.	seed	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	cupule	—	—	—	—
Brambles	*Rubus* sp.	seed	—	—	—	—
Grape	*Vitis vinifera*	seed	55	9	1.00	61.29
Grape	*Vitis vinifera*	pedicel	25	8	0.46	32.26
Grape	*Vitis vinifera (weight)*	skin fragment	0.005	0.005	0.00	3.23
Grape	*Vitis vinifera*	berry	—	—	—	—
Grape	*Vitis vinifera*	tendril	—	—	—	—
Herbs and oilseeds						
Coriander	*Coriandrum sativum*	schizocarp	1	1	0.02	3.23
Linseed	*Linum usitatissumum*	seed	1	1	0.02	3.23

Table 6.9 – *KH-P IV Economic taxa: sum = absolute count; max = maximum count value in a single sample; con-10l% = concentration expressed with a standard value of 10 liters; ub = ubiquity (percentage of samples in which the taxon is found).*

				KH-P VA$_{sum}$	KH-P VA$_{max}$	KH-P VA$_{con\text{-}10l}$	KH-P VA$_{ub\%}$
			Samples | Volume (l)	10 | 195.6	10 | 195.6	10 | 195.6	10 | 195.6
Cereal grains							
	Cereals undif.	Cerealia	caryopsis	P	P	P	100.00
	Cereals undif.	Cerealia	germ	—	—	—	—
	Barley	*Hordeum vulgare*	caryopsis	107	47	5.47	100.00
	Naked barley	*Hordeum vulgare* var. *nudum*	caryopsis	—	—	—	—
	Wheat undif.	*Triticum* sp.	caryopsis	8	4	0.41	50.00
	Free-threshing wheat	*Triticum aestivum /durum*	caryopsis	110	53	5.62	100.00
	Einkorn or Emmer	*Triticum monococcum /dicoccum*	caryopsis	—	—	—	—
	Einkorn	*Triticum monococcum*	caryopsis	—	—	—	—
	Emmer	*Triticum dicoccum*	caryopsis	4	4	0.20	10.00
	Rye	*Secale cereale*	caryopsis	—	—	—	—
	Rye or Wheat	*Triticum /Secale*	caryopsis	—	—	—	—
	Millet undif.	*Panicum /Setaria*	caryopsis	—	—	—	—
	Broomcorn millet	*Panicum miliaceum*	caryopsis	5	5	0.26	10.00
	Foxtail millet	*Setaria italica*	caryopsis	—	—	—	—
Cereal chaff							
	Monocots	Culm fragments (weight)	culm	0.296	0.194	0.02	80.00
	Cereals undif.	Cerealia	rachis segment frg	—	—	—	—
	Cereals undif.	Cerealia	rachis basal segment	—	—	—	—
	Cereals undif.	Cerealia	glume	—	—	—	—
	Barlet undif.	*Hordeum vulgare* – undif.	rachis segment frg	39	24	1.99	60.00
	2-row barley	*Hordeum vulgare* – distichon	rachis segment frg	21	10	1.07	70.00
	6-row barley	*Hordeum vulgare* – hexastichon	rachis segment frg	3	2	0.15	20.00
	Wheat	*Triticum* sp.	rachis segment frg	2	2	0.10	10.00
	Free-threshing wheat	Triticum aestivum/durum	rachis node	13	4	0.66	70.00
	Free-threshing wheat	Triticum aestivum/durum	rachis segment frg	3	2	0.15	20.00
	Free-threshing wheat	Triticum aestivum/durum	rachis segment	—	—	—	—
	Free-threshing wheat	Triticum aestivum/durum	rachis basal segment	4	3	0.20	20.00
	Bread wheat	Triticum aestivum	rachis segment frg	17	12	0.87	40.00
	Bread wheat	Triticum aestivum	rachis segment	5	2	0.26	40.00
	Macaroni wheat	*Triticum durum*	rachis segment	—	—	—	—
	Macaroni wheat (tentative)	*Triticum* cf *durum*	rachis segment	—	—	—	—
	Emmer	*Triticum dicoccum*	spikelet fork	—	—	—	—
	Emmer (tentative)	*Triticum* cf *dicoccum*	glume base	—	—	—	—
	Rye	*Secale cereale*	rachis segment frg	—	—	—	—
Pulses							
	Pulse undif.	Pulse indeterminable	seed	4	4	0.20	10.00
	Chickpea	*Cicer arietinum*	seed	—	—	—	—
	Lentil	*Lens culinaris*	seed	3	2	0.15	20.00
	Common pea	*Pisum sativum*	seed	—	—	—	—
	Broad bean	*Vicia faba*	seed	—	—	—	—
	Bitter vetch	*Vicia ervilia*	seed	19	15	0.97	30.00
	Vetch/field pea	*Vicia /Lathyrus*	seed	—	—	—	—
Fruits and Nuts							
	Hawthorn	*Crataegus* sp.	pyrene	18	16	0.92	20.00
	Russian olive	*Elaeagnus angustifolia*	endocarp	—	—	—	—
	Common fig	*Ficus carica*	seed	—	—	—	—
	Common fig (tentative)	cf *Ficus carica*	seed	—	—	—	—
	Walnut	*Juglans regia*	endocarp	—	—	—	—
	Walnut (tentative)	cf *Juglans regia*	endocarp	—	—	—	—
	Apple or pear	*Pyrus /Malus*	seed	—	—	—	—
	Plum genus	*Prunus* sp.	seed	—	—	—	—
	Oak (tentative)	cf *Quercus* sp.	cupule	—	—	—	—
	Brambles	*Rubus* sp.	seed	1	1	0.05	10.00
	Grape	*Vitis vinifera*	seed	9	2	0.46	70.00
	Grape	*Vitis vinifera*	pedicel	4	2	0.20	30.00
	Grape	*Vitis vinifera (weight)*	skin fragment	—	—	—	—
	Grape	*Vitis vinifera*	berry	—	—	—	—
	Grape	*Vitis vinifera*	tendril	—	—	—	—
Herbs and oilseeds							
	Coriander	*Coriandrum sativum*	schizocarp	—	—	—	—
	Linseed	*Linum usitatissumum*	seed	—	—	—	—

Table 6.10 – *KH-P VA Economic taxa: sum = absolute count; max = maximum count value in a single sample; con-10l% = concentration expressed with a standard value of 10 liters; ub = ubiquity (percentage of samples in which the taxon is found).*

			KH-P VB$_{sum}$	KH-P VB$_{max}$	KH-P VB$_{con-10l}$	KH-P VB$_{ub\%}$
		Samples | Volume (l)	9 | 203	9 | 203	9 | 203	9 | 203
Cereal grains						
Cereals undif.	Cerealia	caryopsis	P	P	P	100.00
Cereals undif.	Cerealia	germ	—	—	—	—
Barley	*Hordeum vulgare*	caryopsis	70	16	3.45	88.89
Naked barley	*Hordeum vulgare* var. *nudum*	caryopsis	—	—	—	—
Wheat undif.	*Triticum* sp.	caryopsis	7	4	0.34	33.33
Free-threshing wheat	*Triticum aestivum /durum*	caryopsis	69	17	3.40	88.89
Einkorn or Emmer	*Triticum monococcum /dicoccum*	caryopsis	—	—	—	—
Einkorn	*Triticum monococcum*	caryopsis	—	—	—	—
Emmer	*Triticum dicoccum*	caryopsis	—	—	—	—
Rye	*Secale cereale*	caryopsis	—	—	—	—
Rye or Wheat	*Triticum /Secale*	caryopsis	—	—	—	—
Millet undif.	*Panicum /Setaria*	caryopsis	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	caryopsis	28	10	1.38	55.56
Foxtail millet	*Setaria italica*	caryopsis	—	—	—	—
Cereal chaff						
Monocots	Culm fragments (weight)	culm	0.658	0.302	0.03	66.67
Cereals undif.	Cerealia	rachis segment frg	—	—	—	—
Cereals undif.	Cerealia	rachis basal segment	—	—	—	—
Cereals undif.	Cerealia	glume	1	1	0.05	11.11
Barlet undif.	*Hordeum vulgare* – undif.	rachis segment frg	11	4	0.54	44.44
2-row barley	*Hordeum vulgare* – distichon	rachis segment frg	1	1	0.05	11.11
6-row barley	*Hordeum vulgare* – hexastichon	rachis segment frg	—	—	—	—
Wheat	*Triticum* sp.	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis node	4	2	0.20	33.33
Free-threshing wheat	Triticum aestivum/durum	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis segment	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis basal segment	—	—	—	—
Bread wheat	Triticum aestivum	rachis segment frg	3	2	0.15	22.22
Bread wheat	Triticum aestivum	rachis segment	—	—	—	—
Macaroni wheat	*Triticum durum*	rachis segment	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	rachis segment	—	—	—	—
Emmer	*Triticum dicoccum*	spikelet fork	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	glume base	—	—	—	—
Rye	*Secale cereale*	rachis segment frg	—	—	—	—
Pulses						
Pulse undif.	Pulse indeterminable	seed	1.5	1	0.07	22.22
Chickpea	*Cicer arietinum*	seed	—	—	—	—
Lentil	*Lens culinaris*	seed	6	3	0.30	33.33
Common pea	*Pisum sativum*	seed	—	—	—	—
Broad bean	*Vicia faba*	seed	—	—	—	—
Bitter vetch	*Vicia ervilia*	seed	2	2	0.10	11.11
Vetch/field pea	*Vicia /Lathyrus*	seed	—	—	—	—
Fruits and Nuts						
Hawthorn	*Crataegus* sp.	pyrene	1	1	0.05	11.11
Russian olive	*Elaeagnus angustifolia*	endocarp	—	—	—	—
Common fig	*Ficus carica*	seed	8	5	0.39	33.33
Common fig (tentative)	cf *Ficus carica*	seed	—	—	—	—
Walnut	*Juglans regia*	endocarp	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	endocarp	—	—	—	—
Apple or pear	*Pyrus /Malus*	seed	—	—	—	—
Plum genus	*Prunus* sp.	seed	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	cupule	—	—	—	—
Brambles	*Rubus* sp.	seed	—	—	—	—
Grape	*Vitis vinifera*	seed	—	—	—	—
Grape	*Vitis vinifera*	pedicel	—	—	—	—
Grape	*Vitis vinifera (weight)*	skin fragment	—	—	—	—
Grape	*Vitis vinifera*	berry	—	—	—	—
Grape	*Vitis vinifera*	tendril	—	—	—	—
Herbs and oilseeds						
Coriander	*Coriandrum sativum*	schizocarp	—	—	—	—
Linseed	*Linum usitatissumum*	seed	—	—	—	—

Table 6.11 – *KH-P VB Economic taxa: sum = absolute count; max = maximum count value in a single sample; con-10l% = concentration expressed with a standard value of 10 liters; ub = ubiquity (percentage of samples in which the taxon is found).*

			KH-P VI$_{sum}$	KH-P VI$_{max}$	KH-P VI$_{con\text{-}10l}$	KH-P VI$_{ub\%}$
		Samples | Volume (l)	2 | 26	2 | 26	2 | 26	2 | 26
Cereal grains						
Cereals undif.	Cerealia	caryopsis	P	P	P	100.00
Cereals undif.	Cerealia	germ	—	—	—	—
Barley	*Hordeum vulgare*	caryopsis	10	5	3.85	100.00
Naked barley	*Hordeum vulgare* var. *nudum*	caryopsis	—	—	—	—
Wheat undif.	*Triticum* sp.	caryopsis	1	1	0.38	50.00
Free-threshing wheat	*Triticum aestivum /durum*	caryopsis	20	14	7.69	100.00
Einkorn or Emmer	*Triticum monococcum /dicoccum*	caryopsis	—	—	—	—
Einkorn	*Triticum monococcum*	caryopsis	—	—	—	—
Emmer	*Triticum dicoccum*	caryopsis	—	—	—	—
Rye	*Secale cereale*	caryopsis	—	—	—	—
Rye or Wheat	*Triticum /Secale*	caryopsis	—	—	—	—
Millet undif.	*Panicum /Setaria*	caryopsis	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	caryopsis	—	—	—	—
Foxtail millet	*Setaria italica*	caryopsis	—	—	—	—
Cereal chaff						
Monocots	Culm fragments (weight)	culm	0.002	0.001	0.00	100.00
Cereals undif.	Cerealia	rachis segment frg	—	—	—	—
Cereals undif.	Cerealia	rachis basal segment	—	—	—	—
Cereals undif.	Cerealia	glume	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	rachis segment frg	1	1	0.38	50.00
2-row barley	*Hordeum vulgare* – distichon	rachis segment frg	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	rachis segment frg	—	—	—	—
Wheat	*Triticum* sp.	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis node	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis segment frg	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis segment	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	rachis basal segment	—	—	—	—
Bread wheat	Triticum aestivum	rachis segment frg	—	—	—	—
Bread wheat	Triticum aestivum	rachis segment	—	—	—	—
Macaroni wheat	*Triticum durum*	rachis segment	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	rachis segment	—	—	—	—
Emmer	*Triticum dicoccum*	spikelet fork	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	glume base	—	—	—	—
Rye	*Secale cereale*	rachis segment frg	—	—	—	—
Pulses						
Pulse undif.	Pulse indeterminable	seed	2	2	0.77	50.00
Chickpea	*Cicer arietinum*	seed	—	—	—	—
Lentil	*Lens culinaris*	seed	3	2	1.15	100.00
Common pea	*Pisum sativum*	seed	—	—	—	—
Broad bean	*Vicia faba*	seed	—	—	—	—
Bitter vetch	*Vicia ervilia*	seed	5	4	1.92	100.00
Vetch/field pea	*Vicia /Lathyrus*	seed	—	—	—	—
Fruits and Nuts						
Hawthorn	*Crataegus* sp.	pyrene	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	endocarp	—	—	—	—
Common fig	*Ficus carica*	seed	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	seed	—	—	—	—
Walnut	*Juglans regia*	endocarp	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	endocarp	—	—	—	—
Apple or pear	*Pyrus /Malus*	seed	—	—	—	—
Plum genus	*Prunus* sp.	seed	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	cupule	—	—	—	—
Brambles	*Rubus* sp.	seed	—	—	—	—
Grape	*Vitis vinifera*	seed	—	—	—	—
Grape	*Vitis vinifera*	pedicel	—	—	—	—
Grape	*Vitis vinifera (weight)*	skin fragment	—	—	—	—
Grape	*Vitis vinifera*	berry	—	—	—	—
Grape	*Vitis vinifera*	tendril	—	—	—	—
Herbs and oilseeds						
Coriander	*Coriandrum sativum*	schizocarp	—	—	—	—
Linseed	*Linum usitatissumum*	seed	—	—	—	—

Table 6.12 – *KH-P VI Economic taxa: sum = absolute count; max = maximum count value in a single sample; con-10l% = concentration expressed with a standard value of 10 liters; ub = ubiquity (percentage of samples in which the taxon is found).*

– *Cereals*

Cereals are the main staple crops attested throughout the sampled sequence (Figure 6.9). Based on chaff and caryopses, 9 cereal taxa are identified: barley – including 2-row (*Hordeum vulgare* subsp. *distichon*), 6-row (*H. vulgare* subsp. *hexastichon*), naked (var. *nudum*), and hulled varieties; bread (*Triticum aestivum*) and macaroni (*T. durum*) wheat; einkorn (*T. monococcum*); emmer (*T. dicoccum*); rye (*Secale cereale*); foxtail (*Setaria italica*) and broomcorn (*Panicum miliaceum*) millet (Figure 6.10 and 6.11). The criteria used to identify cereal grains and chaff are outlined in Appendix 6., to which I refer you for further details.

The diachronic quantitative trend based on cereal grains count is summarized in Figure 6.12. Leaving to a later section (6.4.1) a detailed discussion, we can observe that: (*i*) barley (*Hordeum vulgare*) and free-threshing wheat (*Triticum aestivum/durum*) are the dominant cereals in the entire sampled sequence; (*ii*) hulled wheats (*T. monococcum* and *T. dicoccum*) are found in limited numbers, indicating their very minor importance, or (perhaps more likely) their occasional occurrence as 'tolerated' weeds in free-threshing wheat fields; (*iii*) millets appears to have had some economic importance only during period KH-P VB (1200-1000 BCE). Broomcorn millet (*Panicum miliaceum*) is more abundantly found than foxtail millet (*Setaria italica*), the latter is attested exclusively by single grains during period KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE); finally, (*iv*) rye (*Secale cereale*) is present in meaningful values only during the latest occupation periods here considered (KH-P IIB, 200-1 BCE; and KH-P I 1200-1450 CE), attested by grains and rachis internode – the later showing tough abscission scars indicative of fully domesticated forms.

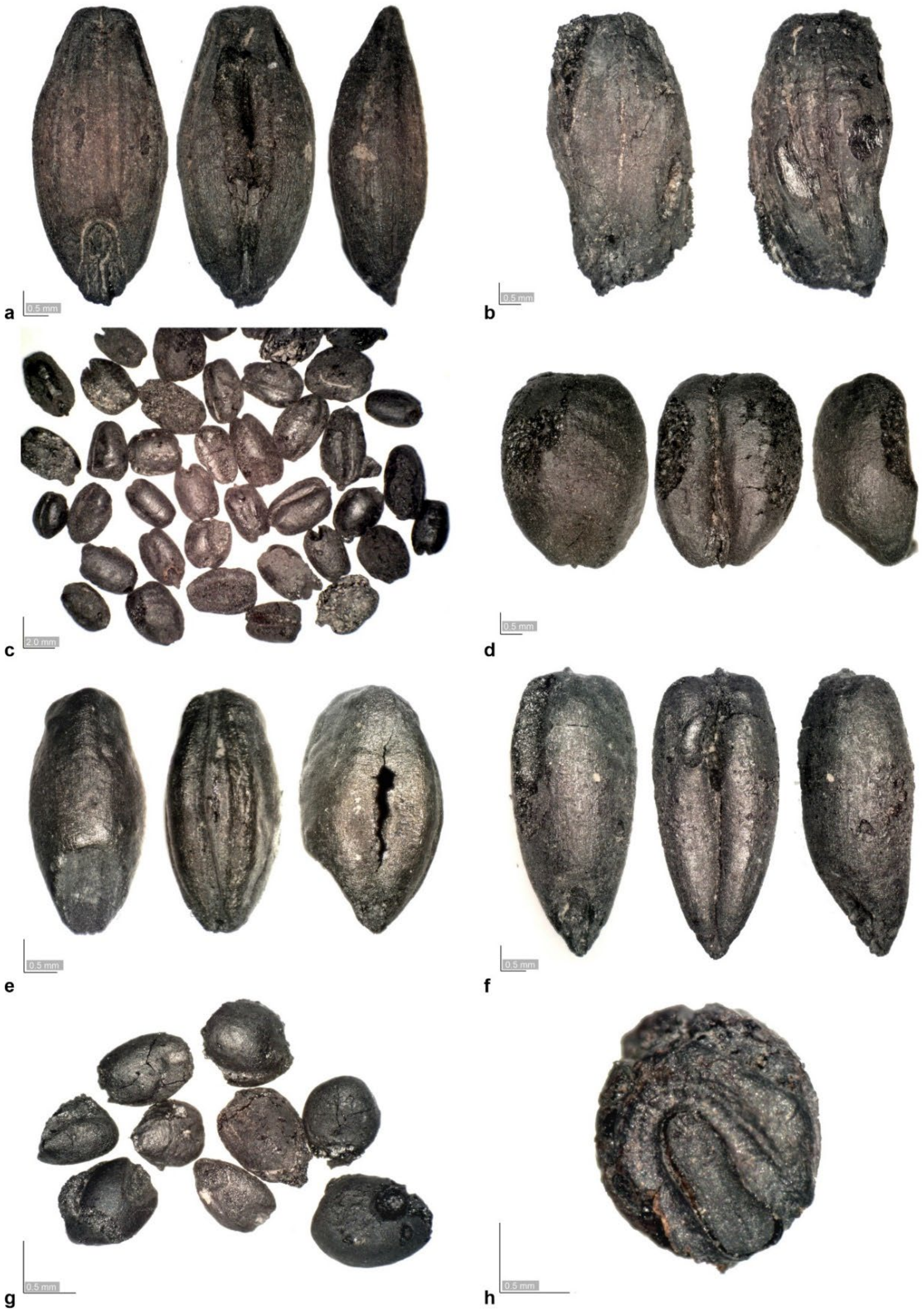
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Figure 6.10 – *Selection of cereals (caryopsis): (a),* Hordeum vulgare, *straight grain (KIN18A1379s31); (b),* Hordeum vulgare, *twisted grain (KIN18C2874s5); (c) and (d),* Triticum aestivum/durum *(KIN18A1379s31); (e),* Triticum monococcum *(KIN13B789s155); (f),* Secale cereale *(KIN14B2031s133); (g),* Panicum miliaceum *(KIN18C2897s35); (h),* Setaria italica *(KIN14B2031s133).*

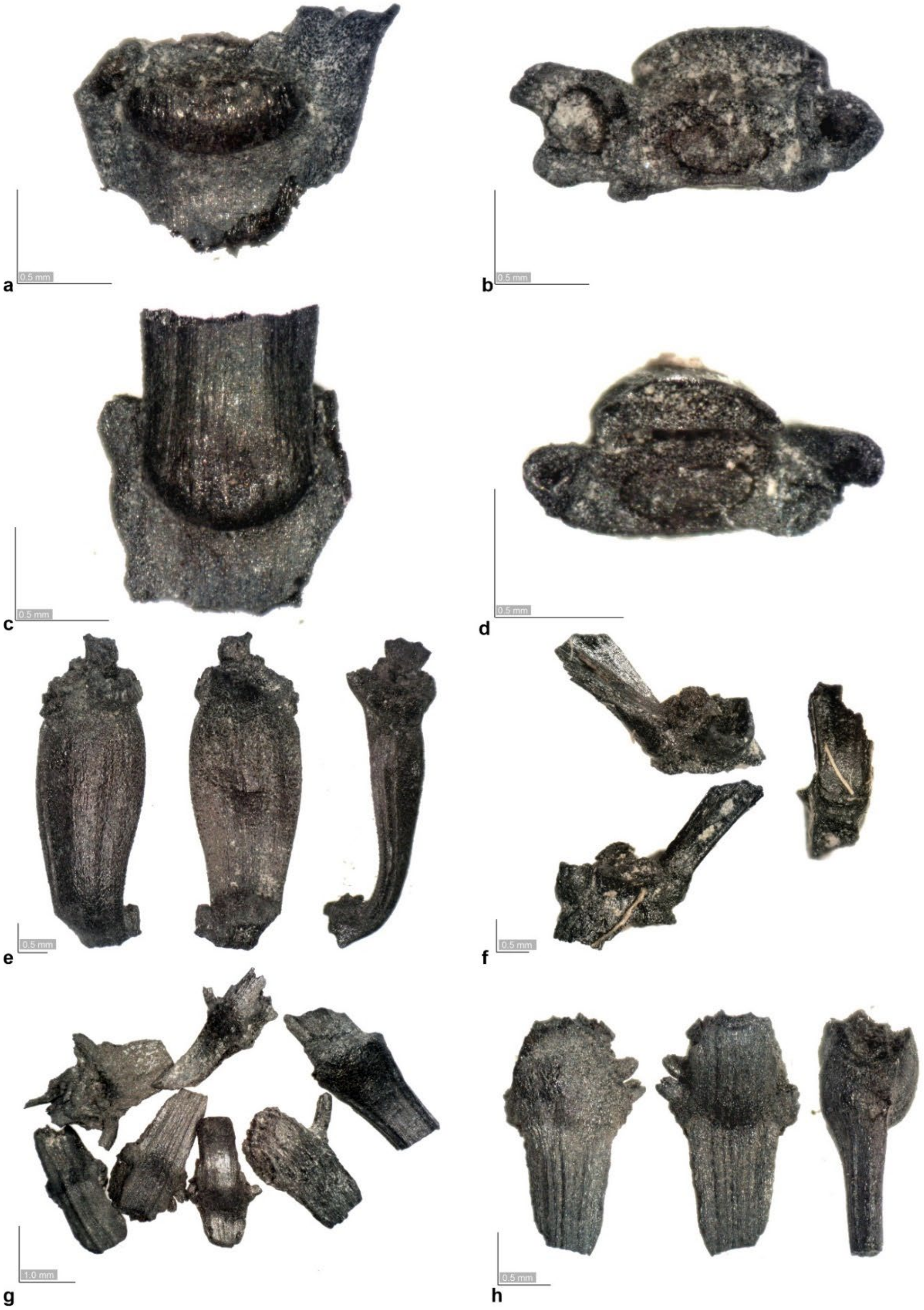
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Figure 6.11 – *Selection of cereals (chaff): (a) and (b)* Hordeum vulgare*, 6-row rachis fragment (KIN12A291s313); (c) and (d),* Hordeum vulgare*, 2-row rachis fragment (KIN18A1377s3); (e),* Triticum aestivum *rachis intenode (KIN14B807s125); (f),* Triticum dicoccum *rachis fork (KIN16B2169s11); (g) and (h),* Secale cereal *rachis internode (KIN14B2031s133).*

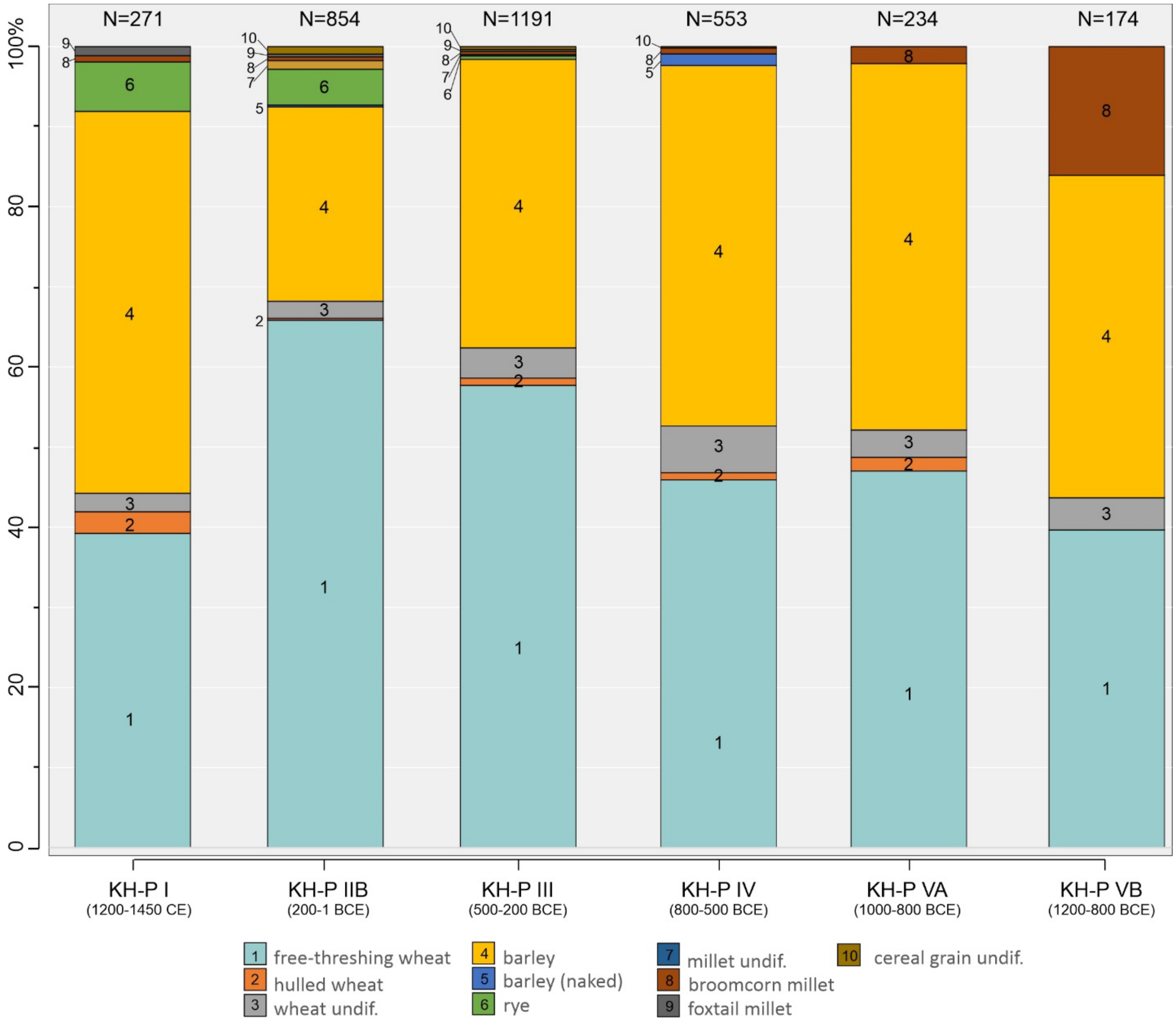

Figure 6.12 – *Bar graph showing the ratio between cereal crops during each occupation period. Rachis and chaff are not included. The total number of cereal grains identified in each period is reported (N).*

Barley and free-threshing wheat account for the 91% of the cereal grains identified in the sequence (Figure 6.12). If we consider the ratio between these two dominant staple crops, it is evident that there was a progressive increase of wheat at the expense of barley (Figure 6.13). Based on caryopsis counts, equal amounts of barley and wheat (ratio ~ 1) are found during the Iron Age (KH-P VB, VA, IV; 1200-500 BCE), which is followed during period KH-P III (500-200 BCE) and KH-P IIB (1-200 BCE) by a significant increase of wheat (Figure 6.13). This trend is reversed during the Medieval occupation (KH-

P I, 1200-1450 CE), with barley becoming more abundant than free-threshing wheat. These observations are further corroborated by the ratio extrapolated from rachis rather than grain counts (Figure 6.13), with only minor discrepancies, which are likely imputable to the differences in taphonomy between these two plant parts.

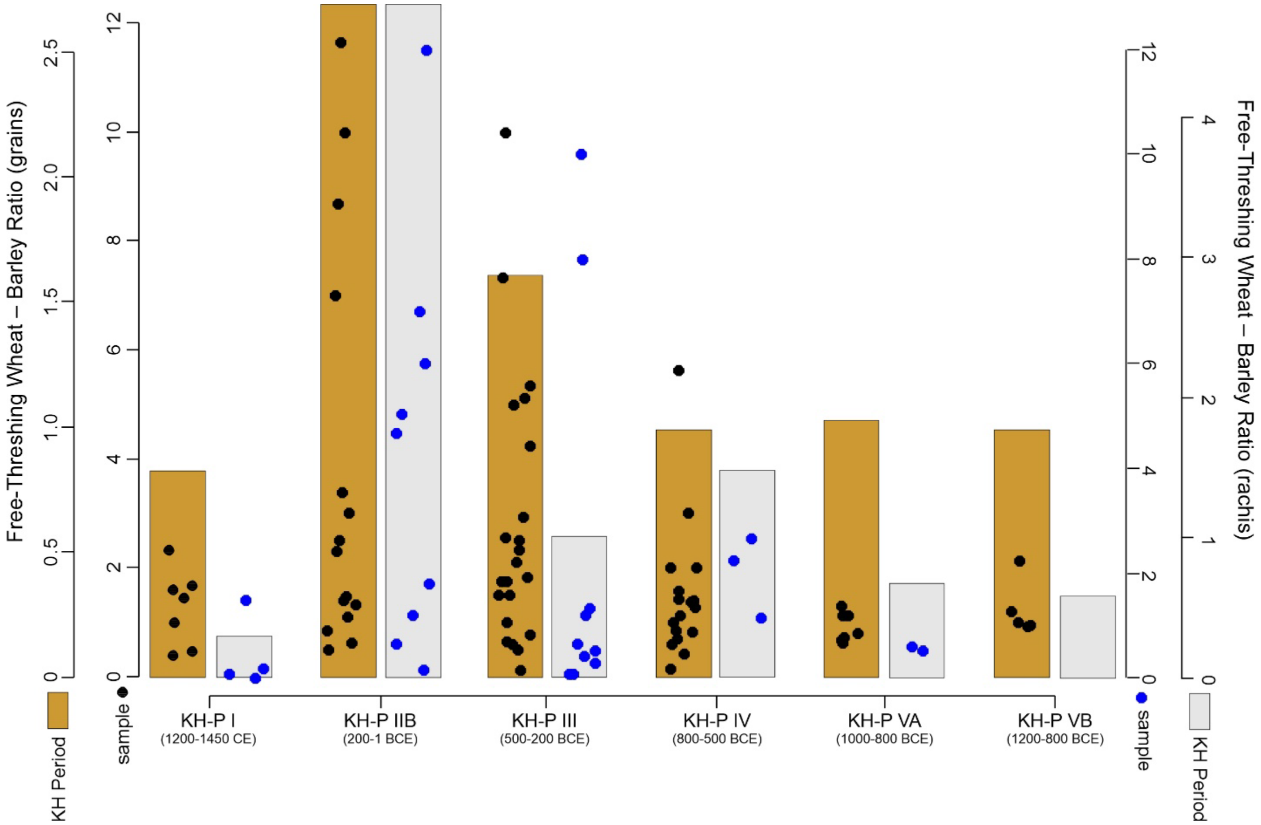

Figure 6.13 – *Free threshing wheat* (Triticum aestivum/durum) *to hulled barley* (Hordeum vulgare) *ratio calculated based on both rachis and grains counts. The bars represent the values calculated for each occupation period, the dots the values recorded in each sample* (*samples with less than 10 caryopsis/rachis fragments are omitted from the figure; samples with only one taxon are not included*).

Domesticated barley (*Hordeum vulgare*) can be classified based on two main criteria: (*i*) the number of fertile florets present at each node of the rachis, which distinguish between two-rowed (*Hordeum vulgare* ssp. *distichon*) and poly-rowed (*H. vulgare* ssp. *hexastichon*) subspecies; and (*ii*) the toughness of the glumes, distinguishing between naked (var. *nudum*) and hulled varieties (Jacomet

2006). Six-row barley is characterized by the presence of three fertile florets at each rachis node: the two lateral spikelets are pushed apart by the central, resulting in the twisted appearance of the laterally borne grains. Two-rowed barley, on the contrary, has only a central fertile floret, with the laterals being sterile. It is, accordingly, predicted that in six-rowed varieties at each node are present two twisted grains (lateral) and one straight (central). Conversely, in 2-rowed barley only straight grains are expected to be found (Jacomet 2006). Based on these considerations, the ratio between twisted and straight grains can be used in order to infer the presence and contribution in the archaeobotanical record of two and/or poly-rowed barley varieties: a ratio of 2 is expected for pure six-row assemblages, while values close to zero define pure 2-rowed barley samples (Jacomet 2006). The presence of a degree of distortion due to charring needs, of course, to be taken into consideration (e.g., Figure 5.10 b). In the record from Niğde-Kınık Höyük, the ratio between twisted (total 86) and straight (total 452) grains is of 0.19, thus indicating the presence of a pure/almost pure two-rowed assemblage (Table 6.13). A slightly higher ratio during the earlier portion of the sequence (KH-P VB, KH-P VA; 1200-800 BCE) is to be critically evaluated, considering the more limited number of specimens available from these periods.

The morphological analysis of barley rachis internodes corroborates the considerations based on the twisted-straight grains ratio (Table 6.13) (see Appendix 6 for identification criteria): rachis fragments attributable to the six-rowed morphotype are documented only by single specimens (Figure 6.11 a and b), which supports a minor economic importance of these varieties, which perhaps were only occasionally occurring in two-rowed barley fields. In this project, the distinction between naked and hulled barley varieties is based on grain anatomy, following the criteria summarized by Jacomet (2006). In the entire assemblage only single barley caryopses having the rounded cross-section typical of naked varieties (Appendix 6) were found. In short, we can reconstruct that the barley present in the assemblage from Niğde-Kınık Höyük is overwhelmingly belonging to hulled two-rowed varieties. The size of the barley caryopses is stable throughout the sampled sequence (Table 6.13), with an average length of 5.9 mm, average breadth of 3.1 mm, and average thickness of 2.3 mm. These values fall within the expected range in domesticated barley (e.g., Nesbitt et al. 2017: 45).

	Caryopsis							**Rachis**		
Period	Straight	Twisted	Indet.	Tw:Sr	Length	Breadth	Thickness	2-row	6-row	Indet.
KH- P I (1200-1450 CE)	53	3	5	0.06	(4) 5.9 (7.7)	(2) 3.2 (4)	(1.4) 2.4 (3.1)	201	1	8
KH- P IIB (200-1 BCE)	80	14	14	0.17	(2.8) 6 (8.2)	(2) 3.1 (4)	(1.2) 2.4 (3.6)	150	6	18
KH- P III (500-200 BCE)	165	27	19	0.16	(4) 5.9 (8)	(1.9) 3.1 (4.1)	(1.2) 2.3 (5.2)	128	1	46
KH- P IV (800-500 BCE)	98	19	22	0.19	(4.2) 5.6 (7.3)	(2) 3 (4.5)	(1) 2.2 (3.5)	21	1	25
KH- P VA (1000-800 BCE)	37	13	7	0.35	(4) 5.9 (7.5)	(1.4) 3 (4.7)	(1) 2.2 (3.8)	21	3	39
KH- P VB (1200-1000 BCE)	19	6	10	0.31	(4.8) 6.2 (7.5)	(2.2) 3.2 (4.3)	(1.5) 2.4 (3.2)	1	0	11

Table 6.13 – *Barley* (H. vulgare)*: ratio between twisted and straight grains, caryopsis measurements, and rachis attributions. For the measures it is reported, in order, the minimum, average, and maximum value recorded in each occupation period. Measures are reported in full in Appendix 8.*

Free-threshing wheat is the second main staple cereal occurring in the sequence. The distinction between tetraploid (*Triticum durum* s.l.; macaroni wheat type) and hexaploid (*T. aestivum* s.l.; bread wheat type) free-threshing wheat cannot be safely made based on the grain morphology (Jacomet 2006). Accordingly, in the dissertation, grains of free-threshing wheat are refereed indistinctively as *T. aestivum/durum*.

Measurements of free-threshing wheat (*T. aestivum/durum*) caryopses are summarized in Table 6.14 and in Figure 6.14. In the literature it is reported for *T. aestivum/durum* a breadth-to-length index (B/L*100) between 54 and 89, with compact forms (*T. aestivum* ssp. *compactum*) having values >65-70, and common wheat (*T. aestivum* s.l.) grains having a B/L*100 ratio <65 (Percival 1974, Jacomet 2006, Rivera et al. 2011). The measures of the free-threshing wheat caryopses from Niğde-Kınık Höyük are within the expected range, with an average length of 4.4 mm, breadth of 2.9 mm, and thickness of 2.3 (Appendix 8).[32] A unimodal distribution in class sizes (Figure 6.14) could hint to the presence of a single morphometric population. The occurrence of compact forms cannot be, however, fully ruled out.

	Caryopsis *(Triticum aestivum/durum)*			
Period	N	Length	Breadth	Thickness
KH- P I (1200-1450 CE)	56	(3.1) 4.5 (5.7)	(2.0) 3.0 (3.8)	(1.5) 2.3 (3.1)
KH- P IIB (200-1 BCE)	247	(2.2) 4.5 (5.8)	(1.4) 3.1 (4.3)	(1.0) 2.4 (3.5)
KH- P III (500-200 BCE)	439	(2.0) 4.3 (6.8)	(1.4) 2.8 (5.5)	(1.0) 2.2 (22)
KH- P IV (800-500 BCE)	177	(1.7) 4.2 (6.0)	(1.0) 2.8 (4.0)	(1.0) 2.3 (3.8)
KH- P VA (1000-800 BCE)	65	(2.9) 4.4 (5.7)	(1.9) 3.0 (4.3)	(1.6) 2.4 (3.5)
KH- P VB (1200-1000 BCE)	29	(3.6) 4.5 (5.6)	(1.9) 2.9 (4.0)	(1.5) 2.3 (3.0)

Table 6.14 – *Free-Threshing wheat caryopsis measurements: minimum, average, and maximum value recorded in each occupation period. Measures are reported in full in Appendix 8.*

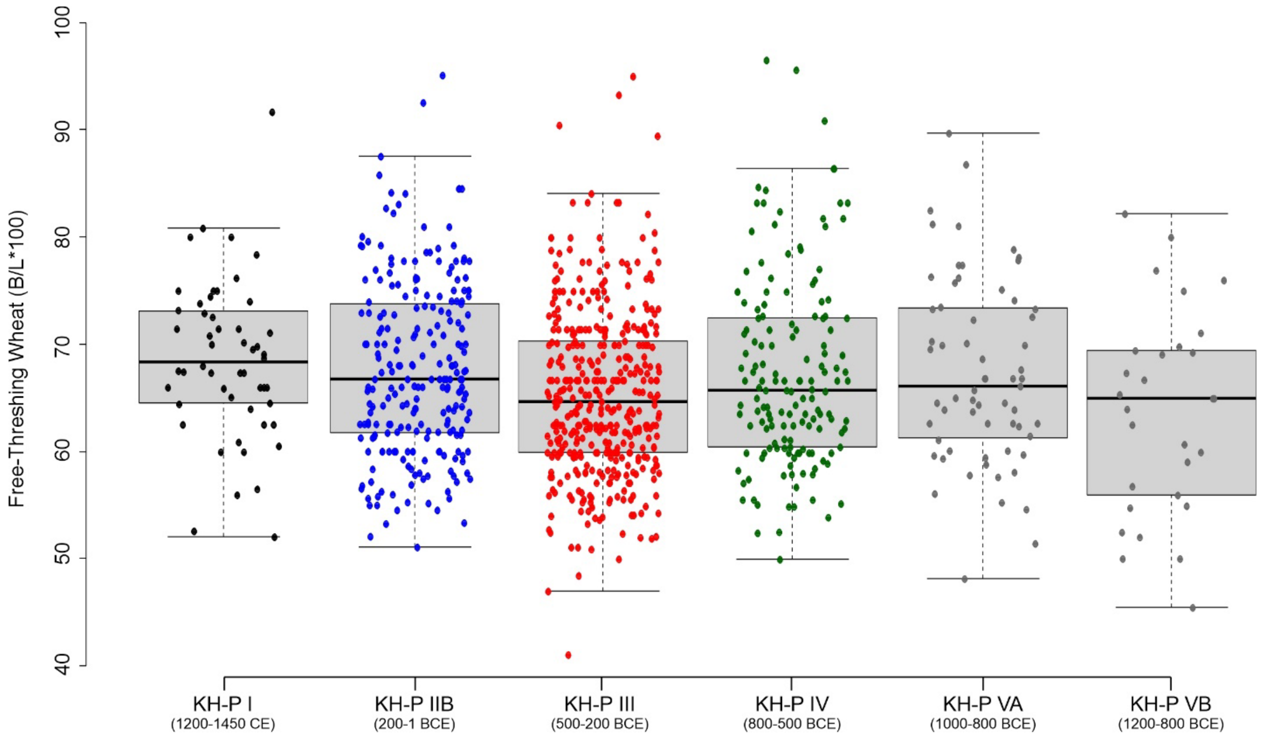

Figure 6.14 – *Measurements of free threshing wheat caryopsis: breath to length ratio (B/L*100). The box plots represent values in each occupation period; each dot represent a single specimen.*

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[32] Note that charring impacts differently the length and the breadth of the caryopsis (Braadbaart 2008).

Contrary to caryopses, the identification at ploidy level of free-threshing wheat can be more safely conducted on chaff remains, following the criteria summarized by Jacomet (2006, with further references), which are also reported in Appendix 6. Based on these criteria, the free-threshing wheat rachis fragments from Niğde-Kınık Höyük are overwhelmingly attributable to the *Triticum aestivum* (bread wheat type) morphotype (Figure 6.11, e). *Triticum durum* (macaroni wheat) appears to have had a very marginal (if any) importance in the assemblage. Following a conservative approach, an identification to the ploidy level was not aimed in rachis fragments preserving exclusively the node, without portions of the internode. The latter specimens have been accordingly identified and counted as *Triticum aestivum/durum*.

Measurement statistics of entire free-threshing wheat rachis fragments are provided in Table 6.15. On average, the length of the rachis segment range between 3.0 (KH-P IIB) and 3.7 mm (KH-P VA). On modern materials, hexaploid free-threshing wheat (*Triticum aestivum* s.l.) could be divided into lax-eared (rachis segments >4 mm) and dense-eared (<4 mm) varieties (Jacomet 2006). Allowing for a degree of shrinking due to the charring, the majority of the specimens from Niğde-Kınık Höyük appears to fall in between dense and lax-eared varieties.

	Rachis (*Triticum aestivum*)					
Period	N	Length	min-Breadth	max-Breadth	min-Thickness	max-Thickness
KH- P I (1200-1450 CE)	4	(2) 3.2 (4.9)	(1.2) 1.4 (1.8)	(1.6) 2 (2.4)	(0.3) 0.4 (0.8)	(0.8) 0.9 (1.1)
KH- P IIB (200-1 BCE)	24	(1.7) 3.0 (4.0)	(0.4) 1.2 (1.6)	(0.8) 1.8 (2.4)	(0.2) 0.4 (0.8)	(0.2) 0.7 (1.0)
KH- P III (500-200 BCE)	13	(2.0) 3.5 (5.0)	(0.9) 1.3 (2.5)	(1.5) 2.0 (3.5)	(0.2) 0.4 (0.6)	(0.6) 0.8 (1.3)
KH- P IV (800-500 BCE)	7	(2.3) 3.1 (4.1)	(1.0) 1.3 (2.1)	(1.2) 1.7 (2.0)	(0.1) 0.3 (1.0)	(0.2) 0.6 (0.7)
KH- P VA (1000-800 BCE)	4	(3.2) 3.7 (4.7)	(1.4) 1.5 (1.8)	(1.2) 1.8 (2.0)	(0.2) 0.3 (0.4)	(0.7) 0.8 (0.9)
KH- P VB (1200-1000 BCE)	0	—	—	—	—	—

Table 6.15 – *Bread wheat rachis* (Triticum aestivum) *measurements. For the measures it is reported, in order, the minimum, average, and maximum value recorded in each occupation period. Measures are reported in full in Appendix 8.*

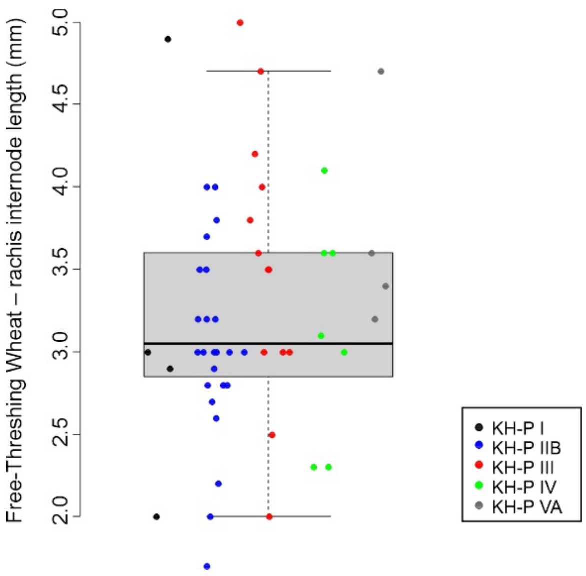

Figure 6.15 – *Measurements (length) of bread wheat* (Triticum aestivum) *rachis internode. The box plot represents values recorded for the whole assemblage; each dot represents a measured specimen.*

– *Pulses*

Pulses are a ubiquitous component of the crop assemblage from Niğde-Kınık Höyük, although occurring in comparatively low counts – with the sole exception of single concentrations (e.g., KIN17A1894S158 and KIN17A1894S157). In the sampled sequence, a total of five pulse taxa were identified, all representing well-known crops of economic importance in western Asia (Zohary et al 2000: 75-99, Marston and Castellano 2021: 346-347): lentils (*Lens culinaris*), bitter vetch (*Vicia ervilia*), common pea (*Pisum sativum*), chickpea (*Cicer arietinum*), and broad bean (*Vicia faba*) (Figure 6.16).

The diachronic trend in the pulses assemblage is summarized in Figure 6.17, reporting ubiquity (percentages of samples in which these taxa are found), the pulses-to-cereal ratio (which allows to standardize the abundance of pulses against cereal grains), and the composition of the assemblage during the different occupation periods.

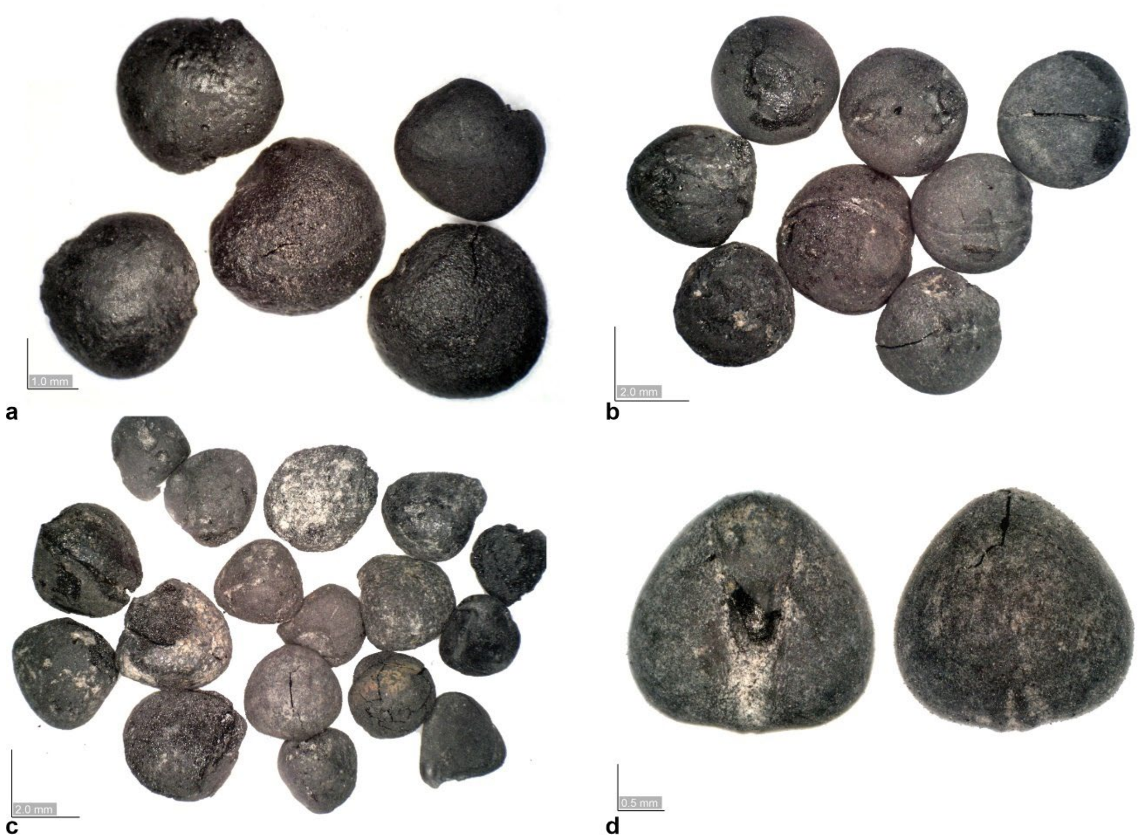

Figure 6.16 – *Main pulses:* (*a*), Lens culinaris (*KIN18A1377s31*); (*b*), Pisum sativum (*KIN15B2091s57*); (*c*) *and* (*d*), Vicia ervilia (*KIN14A153s32*).

Lentils and bitter vetch are by far the dominant pulses in the record, accounting altogether for the 94% of the identified seeds belonging to this group of economic plants. Common pea is attested during period KH-P III (500-200 BCE) and, especially, KH-P IIB (200-1 BCE). Pea was, thus, likely cultivated in the second half of the 1st millennium BCE, although representing a crop of possible secondary importance. The increase in abundance of bitter vetch during period KH-P III (Figure 6.17) is, in large part, driven by two samples (KIN17A1894s158 and KIN17A1894s157) containing concentrations of this taxon (Appendix 8). These two samples were rich in *Vicia ervilia* seeds and are also determining the general increase in the pulses-to-cereals ratio, which is otherwise relatively stable throughout the analyzed sequence (Figure 6.17).

The other two pulses attested at the site include chickpeas (*Cicer arietinum*) and fava beans (*Vicia faba*) and are documented only in single specimens, suggesting their marginal role (if any) in the local agricultural system. I should note a significant increase in pulse ubiquity starting from period KH-P III (500-200 BCE) (Figure 6.17, a).

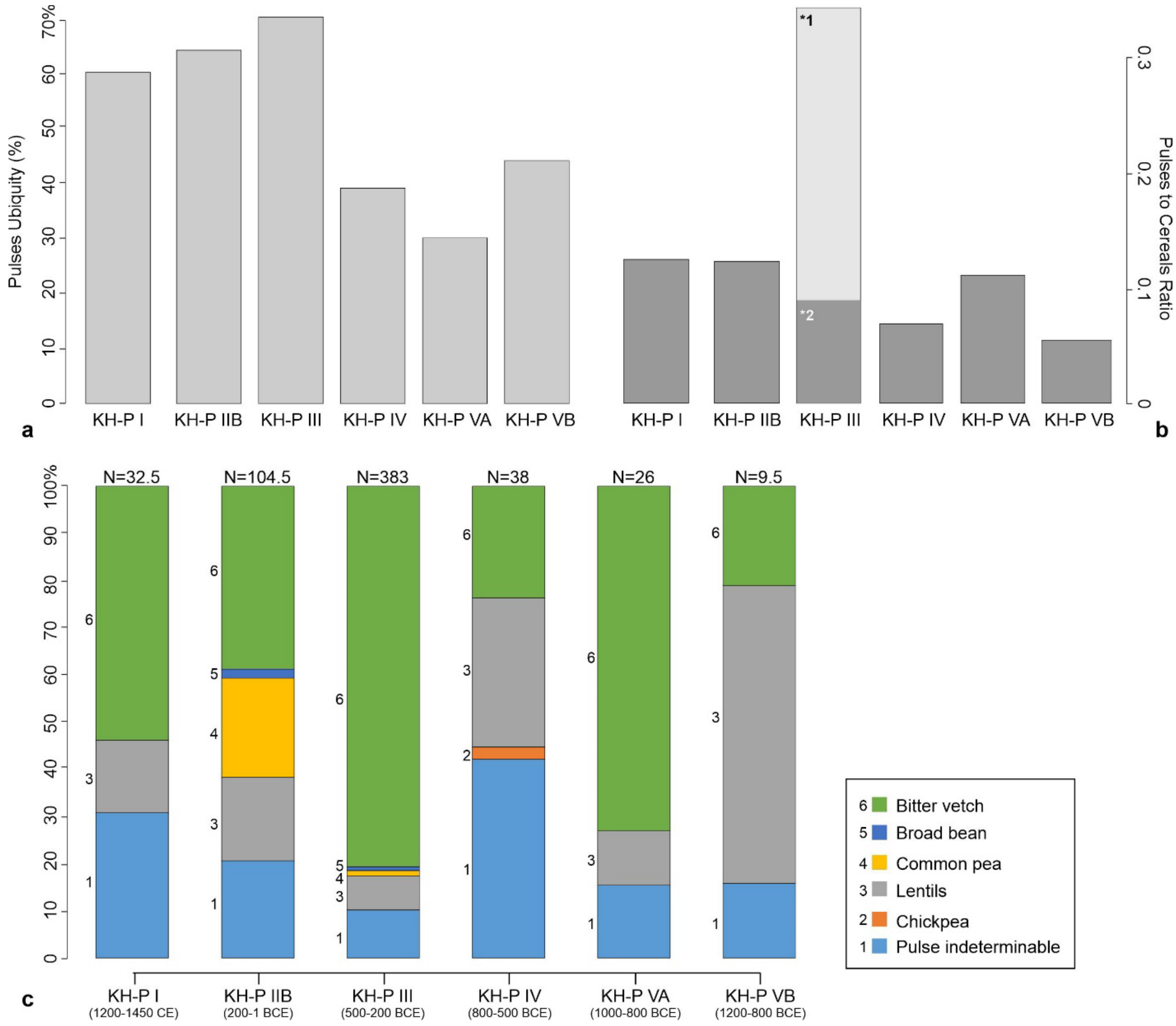

Figure 6.17– *(a), ubiquity of pulses (percentage of samples in each occupation period that contain pulses); (b), ratio between cereals and pulses. Values for period KH-P III are plotted both including (*1) and excluding (*2) the two samples with concentrations of bitter vetch seeds (KIN17A1894s158 and KIN17A1894s157); (c), bar graph showing the ratio between the pulses identified during each occupation period. On top of the graph, it is reported the total number of pulse seeds identified (N).*

– Fruits and Nuts

As I will further discuss in Section 6.4, the carpological assemblage from Niğde-Kınık Höyük stands out for the abundance and ubiquity of fruit and nut taxa (Figure 6.8, Figure 6.9, Table 6.5), confirming the regional importance of arboriculture already hypothesized on the basis of wood charcoal analysis (Chapter 5). Altogether, nine fruit and nut taxa of potential economic interest were identified, including both wild and cultivated plants (Figure 6.18 and Figure 6.19). On a phytogeographic basis, to the latter are likely to be attributed grapevine (*Vitis vinifera*), Russian olive (*Elaeagnus angustifolia*), walnut (*Juglans regia*), and common fig (*Ficus carica*). On the other hand, hawthorn (*Crataegus* sp.), apple/pear (*Malus/Pyrus* sp.), and plums (*Prunus* sp.) possibly represent wild taxa exploited for their edible products. As already noted in Section 5.4.3, the distinction between cultivated and wild varieties is intrinsically challenging, considering the traditional economic importance in central Anatolia of exploitation of wild fruit trees (e.g., Ertuğ 2000).

Different plant materials are not expected to be equally represented in charred archaeobotanical assemblages, due to the different likelihood of undergoing charring during the activities in which they are directly or indirectly involved (Section 2.1.1) (van der Veen 2007). As a result, fruits and nuts are generally underrepresented, with the notable exception of by-products used as fuel resource (e.g., grape marc and olive pressing residues). In light of these considerations, it was considered more appropriate to analyze the attestation of fruit and nut taxa based on ubiquity (Figure 6.19) rather than relative abundance. Quantitative consideration based on relative abundances and concentrations will be made only for grape (*Vitis vinifera*), which represent by far the most abundant fruit crop documented in the sequence (Figure 6.20).

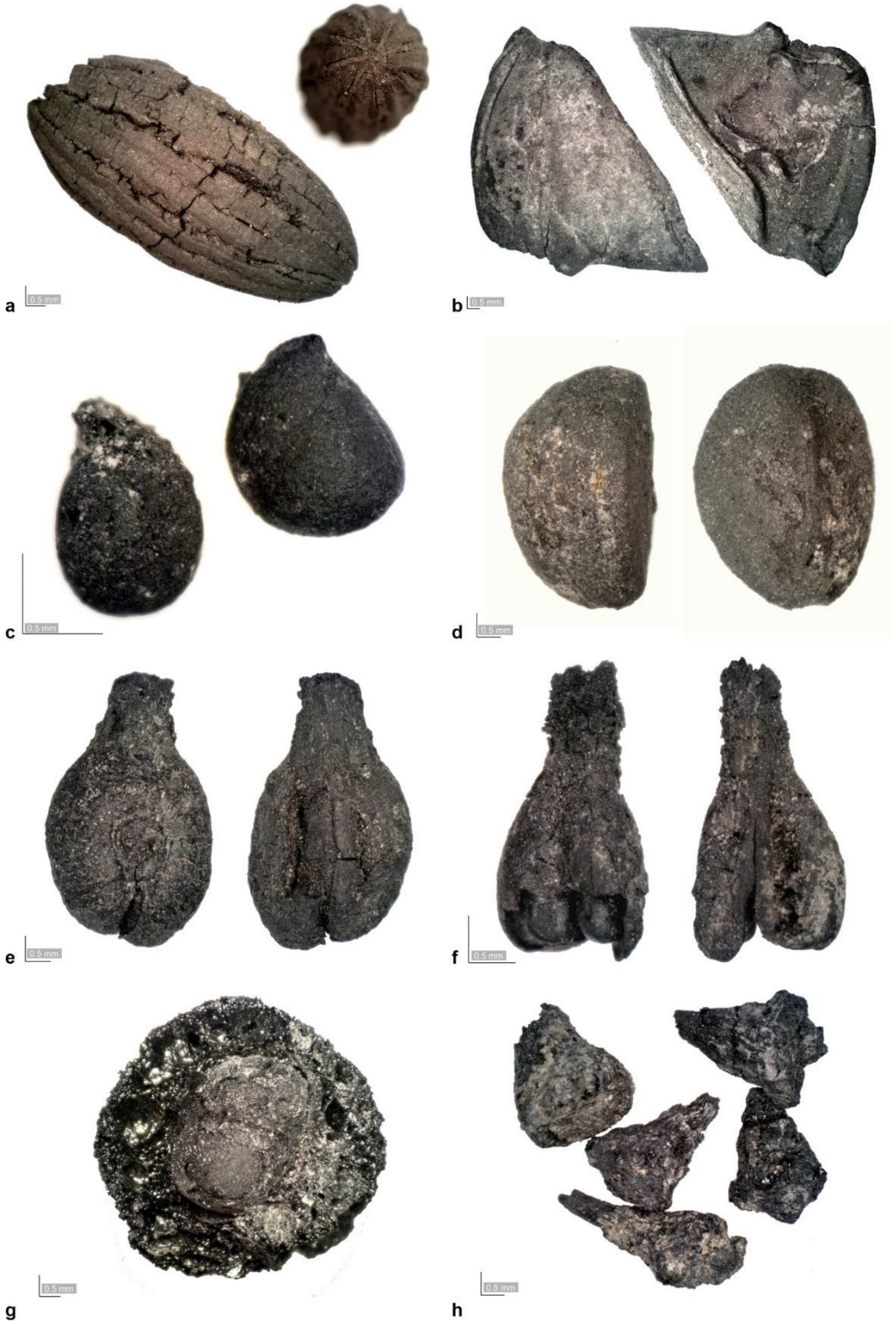
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Figure 6.18 – *Main fruit crops attested at Niğde-Kınık Höyük:* (*a*), Elaeagnus angustifolia (*KIN13A175s117);* (*b*), Juglans regia (*KIN15A1676s93);* (*c*), Ficus carica (*KIN18C3403s43*); (*d*), Crataegus *sp.* (*KIN14A153s32);* (*e*), Vitis vinifera, *seed* (*KIN13B807s175*); (*f*). Vitis vinifera, *undeveloped seed* (*KIN13B807s175); (g),* Vitis vinifera, *berry* (*KIN13B807s175);* (*h*), Vitis vinifera, *pedicels* (*KIN14D1126s4*).

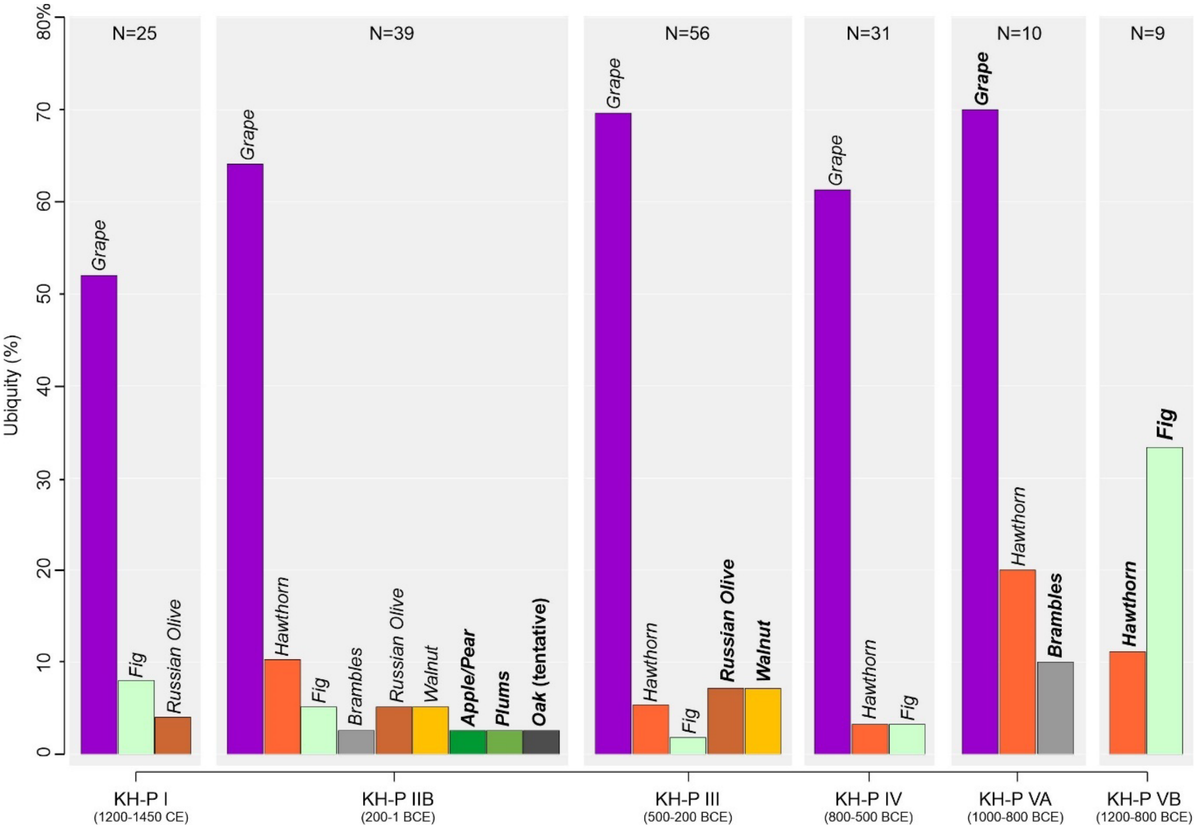

Figure 6.19 – *Main fruit crops attested at Niğde-Kınık Höyük, graph showing ubiquity (percentage of samples in which the taxon is found) calculated for each occupation period. On top of the graph, it is reported the total number of samples analyzed for each occupation period (N).*

Hawthorn and fig are attested throughout the entire sequence, although in low counts and ubiquity (Figure 6.19). Grape is documented starting with period KH-P VA (1000-800 BCE), in the form of pedicels, seeds, (Figure 6.8 and 6.20), and charcoal (Chapter 6). We cannot rule out that the complete lack of grape macro-remains during period KH-P VB (1200-1000 BCE) could be partially due to limited sampling. Following its first appearance, grape is thereafter attested in both high ubiquity and abundance (see below). Starting with period KH-P III, Russian olive and walnut are attested for the first time (Figure 6.9), which matches and confirms their earliest occurrence in the wood charcoal record (Section 5.4.3).

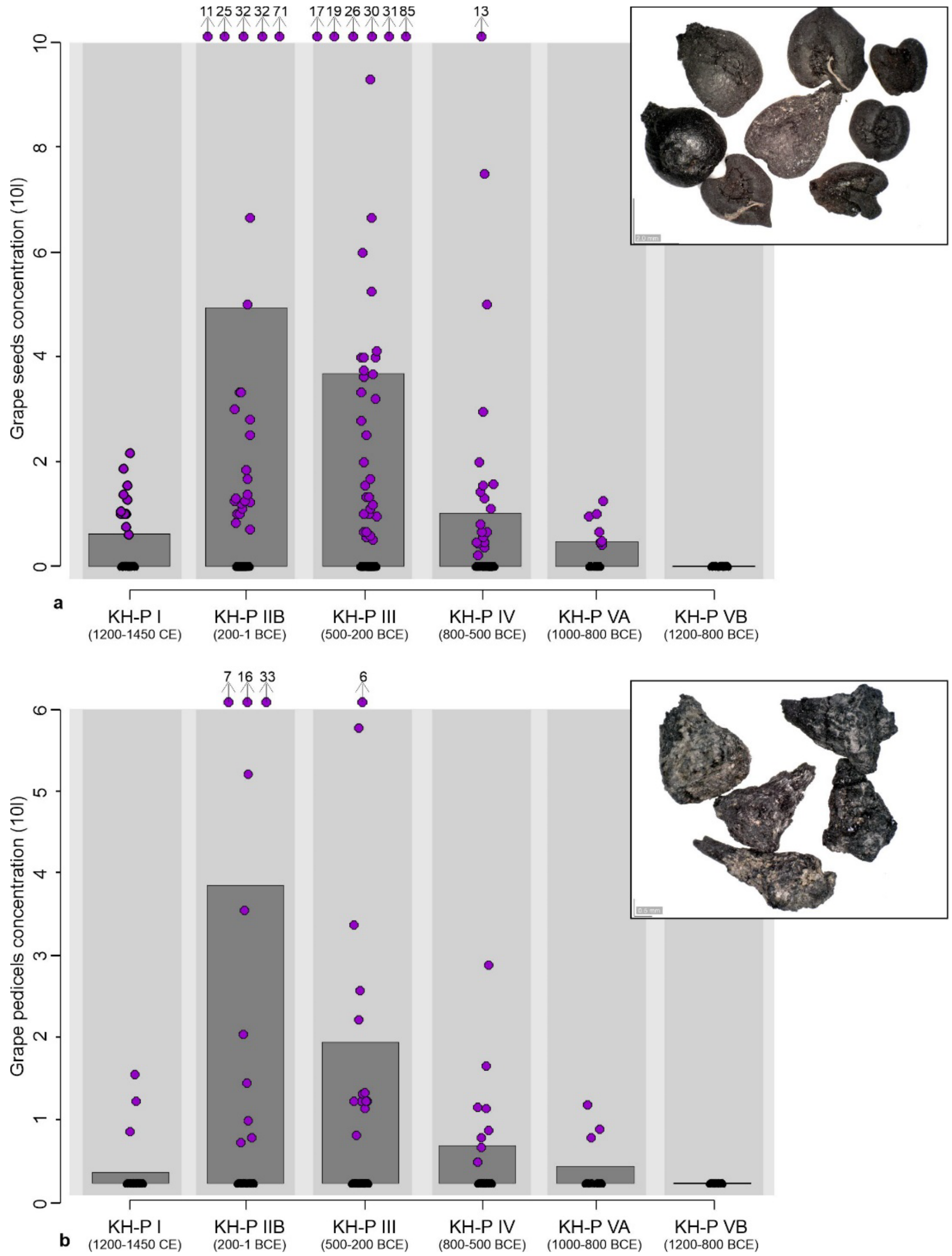

Figure 6.20 – *Concentration of grape* (Vitis vinifera) *seeds* (*a*) *and pedicels* (*b*). *Bars indicate values calculated for each occupation period; each dot represent a single sample. Values exceeding the Y axis are reported on top of the graph.*

Grape (*Vitis vinifera*) is by far the most important fruit crop in the sequence, second in the entire economic assemblage only to free-threshing wheat and barley. In addition to wood charcoal, discussed in Chapter 5, this crop is documented in form of seeds, pedicels, entire berries, (Figure 6.18, e-h), skin fragments, and possibly tendrils (Appendix 6). Figure 6.20 summarizes the quantitative attestation (concentrations) of grape seeds and pedicels: the observed trend clearly indicates a progressive increase of both types of remains, peaking in the second half of the 1st millennium BCE (period KH-P III, 500-200 BCE; and KH-P IIB, 200-1 BCE). In Section 6.4.4, I will provide a discussion of viticulture at Niğde-Kınık Höyük based on the carpological and wood charcoal evidence.

– *Other economic plants*

A final mention should be made of two other possible economic taxa documented in the sequence in single specimens: flax (*Linum usitatissimum*) and coriander (*Coriandrum sativum*) (Figure 6.21), both attested during period KH-P IV (800-500 BCE) (Table 6.5).

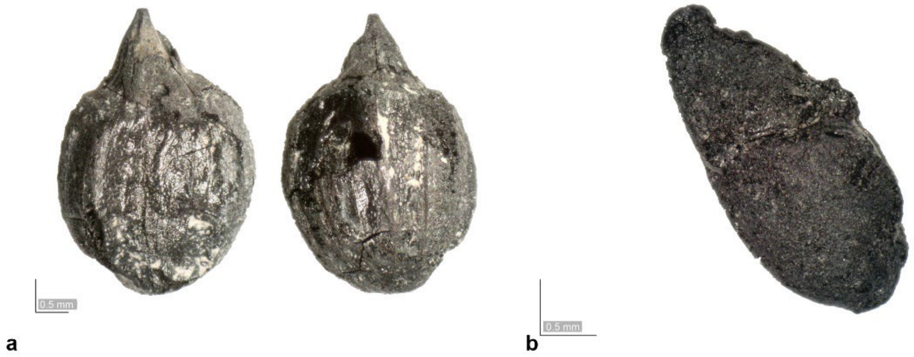

Figure 6.21 – *a,* Coriandrum sativum (*KIN17A1878s165*), *b,* Linum usitatissimum (*KIN12A291s313*)

6.3.4 *Wild and weed taxa*

The carpological record from Niğde-Kınık Höyük includes an abundant and rich wild and weed flora (Figure 6.23, 6.24, 6.25), which (including unknowns) accounts for the 85% of the analyzed carpological remains. A total of 34 botanical families were identified (Table 6.2). Whenever possible, identifications were aimed to the genus or species level. An adequate taxonomic level in the identifications, however, was not always feasible, mostly due to the complexity of the central Anatolian flora, which is still relatively poorly known and not adequately covered in available reference collections and carpological literature – as it has been already noted by other scholars (e.g., Fairbairn et al. 2007: 470). Identification criteria, candidate taxa in the Turkish flora, and ecological considerations are provided in Appendix 6.

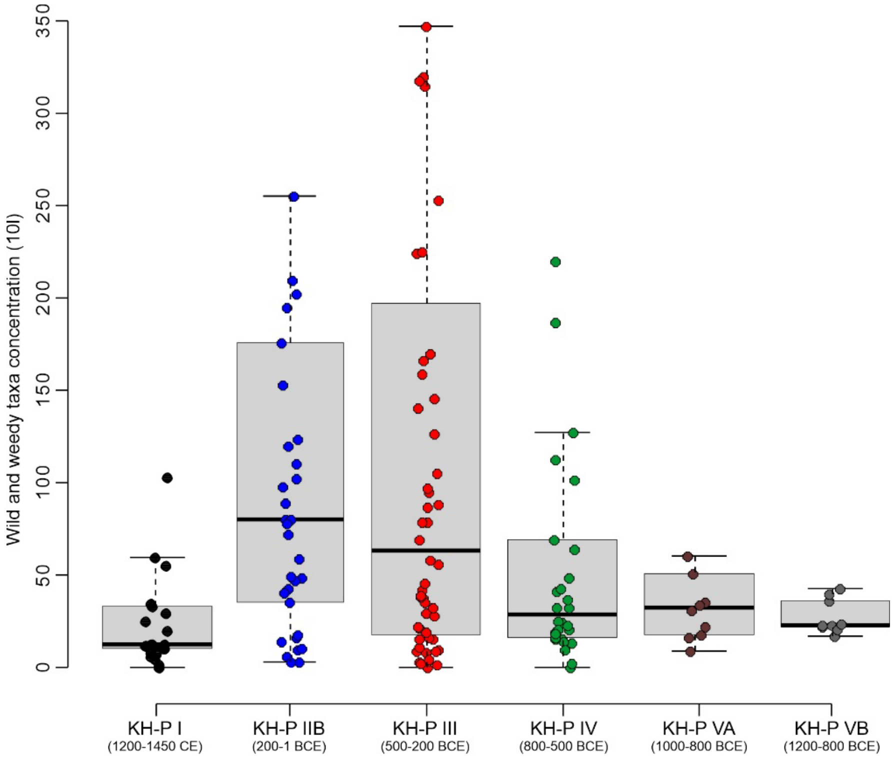

Figure 6.22 – *Concentrations of wild and weedy taxa seed/fruit remains, expressed in reference to a standard 10 l sample. The box plots represent values calculated for each occupation period; each dot represent a single specimen. Unknown taxa and indeterminable specimens are not included in the computation.*

As shown in Figure 6.22, the concentration of wild and weedy taxa (including unknowns) significantly increases during period KH-P III and KH-P IIB, corresponding to the second half of the 1st millennium BCE. In Section 6.4.1, I will discuss this trend in connection to a possible intensification of dung-burning activities at the site. Carpological data on wild and weedy taxa are presented in Figure 6.26 and in Tables 6.16-22.

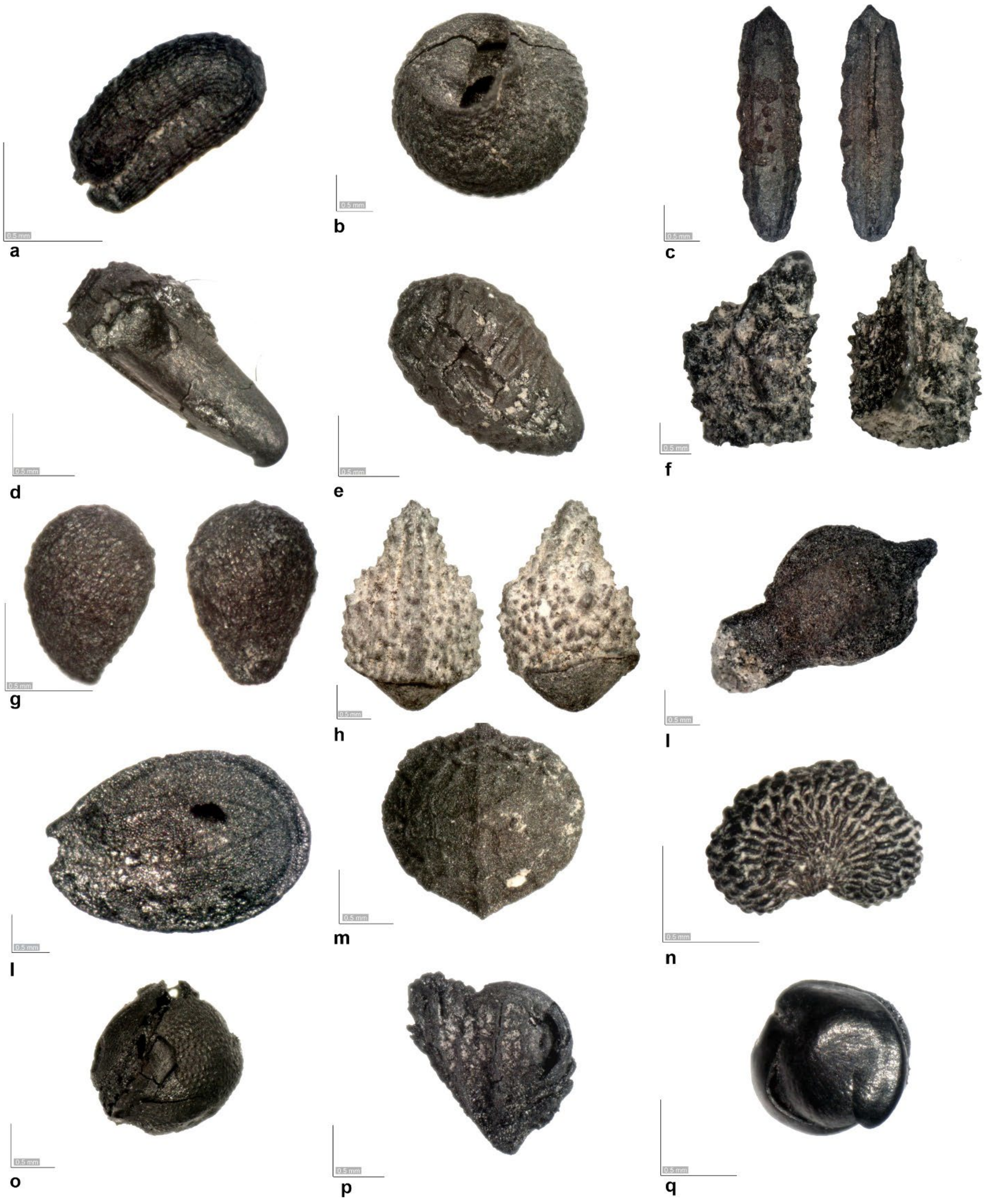
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Figure 6.23 – *Selection of wild-weedy taxa from Kınık Höyük:* (*a*), Alisma *sp;* (*b*), Bifora radians*;* (*c*), Torilis *sp.;* (*d*), Centaurea *sp.;* (*e*), Onopordum *sp.;* (*f*)*;* Echium *sp.;* (*g*), Heliotropium *sp.,* (*h*), Buglossoides arvensis/Arnebia decumbens*;* (*i*), Euclidium syriacum*;* (*l*), Lepidium perfoliatum*;* (*m*), Neslia paniculata*;* (*n*), Silene *sp.;* (*o*), Vaccaria pyramidata*;* (*p*), Atriplex *sp., seed inside bract;* (*q*), Chenopodium *sp.*

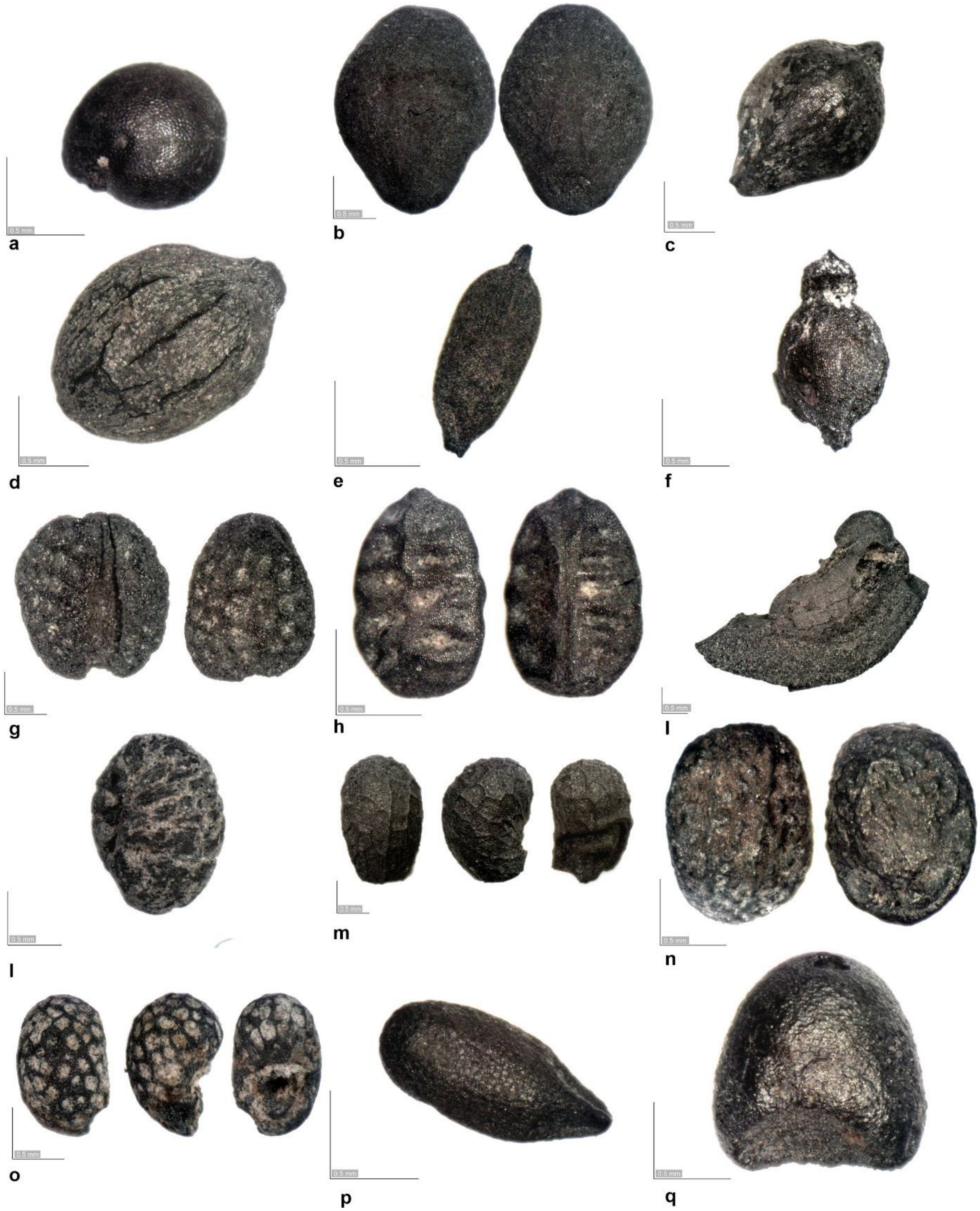


Figure 6.24 – *Selection of wild-weedy taxa from Kınık Höyük:* (*a*), Suaeda *sp.;* (*b*), Convolvulus *sp.;* (*c*), Bolboschoenus glaucus*;* (*d*), Carex *sp., flattened achene;* (*e*), Cyperus longus *type;* (*f*), Eleocharis *sp.;* (*g*), Euphorbia taurinensis-*Type;* (*h*), Euphorbia falcata-*Type;* (*i*), Medicago *sp., seed in pod fragment;* (*l*), Medicago radiata*;* (*m*), Ajuga-*Type;* (*n*), Nepeta *sp.;* (*o*), Teucrium-*Type;* (*p*), Ziziphora *sp.;* (*q*), Ornithogalum *sp.*

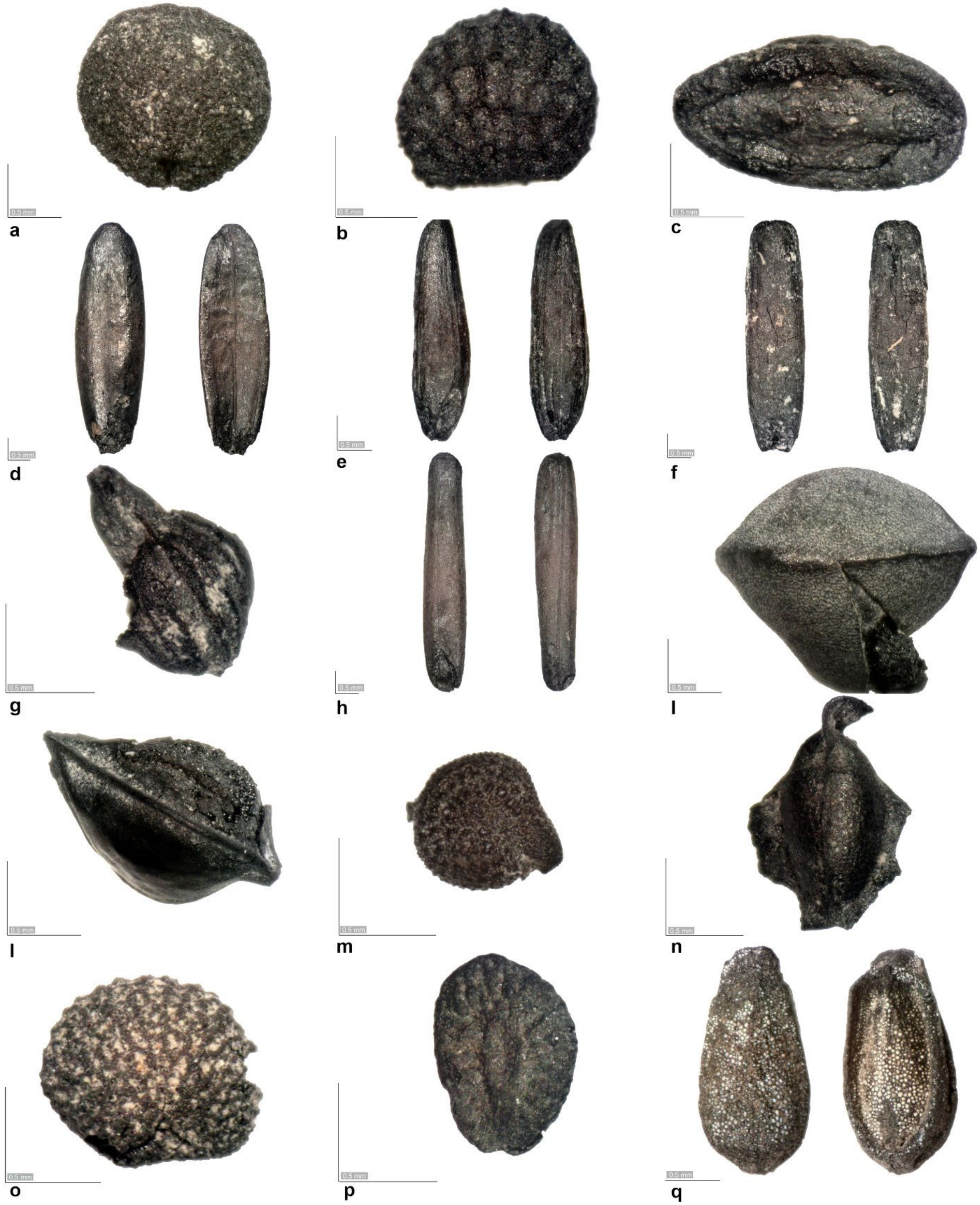


Figure 6.25 – *Selection of wild-weedy taxa from Kınık Höyük:* (*a*), Fumaria *sp.;* (*b*), Glaucium *sp.;* (*c*), Plantago *sp.;* (*d*), Bromus *sp.;* (*e*), Eremopyrum *type;* (*f*), Lolium *sp.;* (*g*), Poa bulbosa, *spikelet;* (*h*), Stipa *sp.;* (*i*), Polygonum convolvulus*;* (*l*), Rumex *sp.;* (*m*), Portulaca oleracea*;* (*n*), Ceratocephalus falcatus*;* (*o*), Hyoscyamus *sp.;* (*p*), Veronica dilleniid-*Type;* (*q*), Valerianella coronate-*Type.*

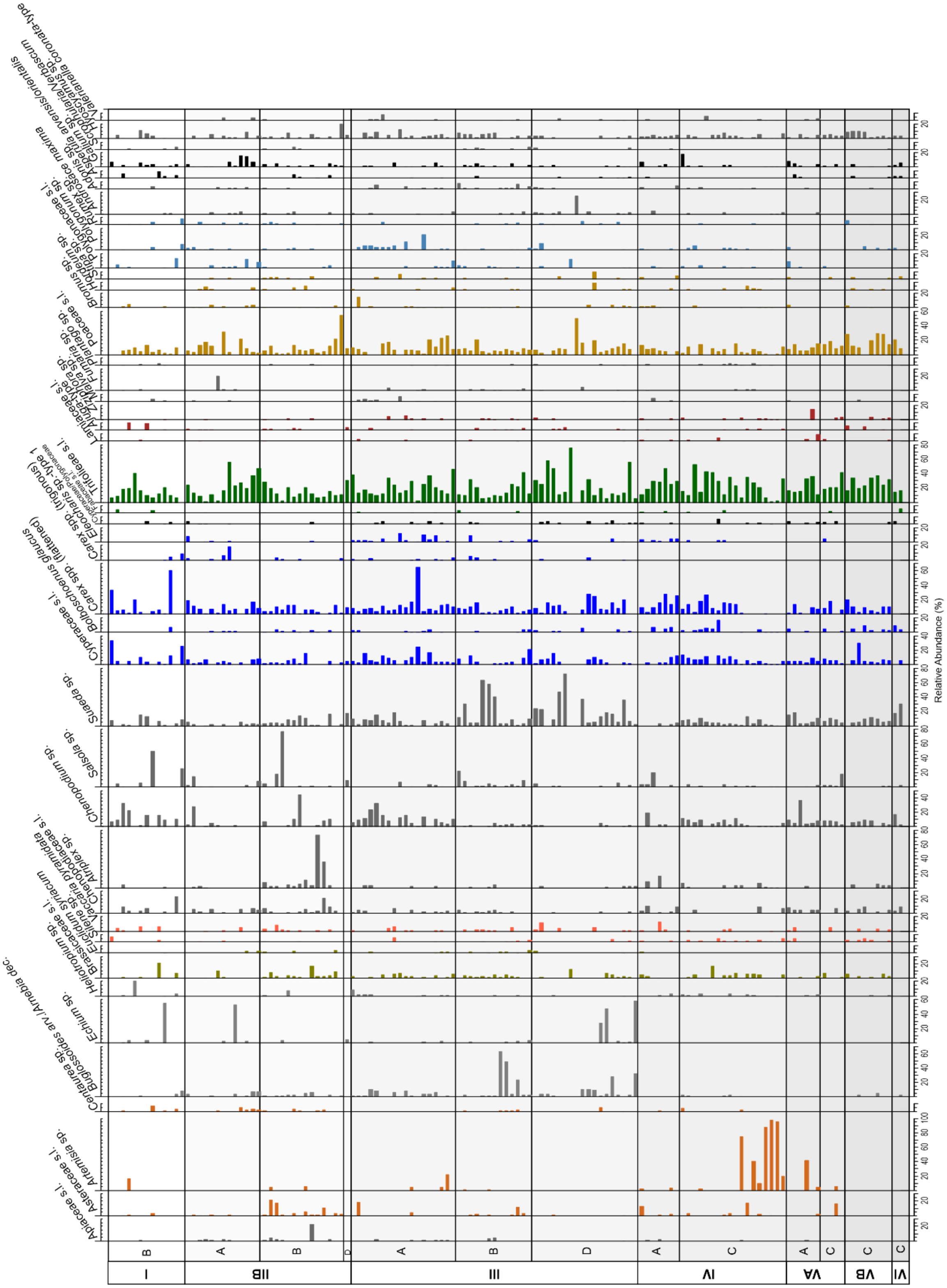


Figure 6.26 – *Graph presenting the sample-by-sample wild and weed taxa. The graph is based on relative abundance, calculated including in the sum only the taxa that are present in more than the 10% of the samples. Unknown and indeterminable specimens are not included in the sum. Samples with less than 20 wild-weed seed/fruit remains are excluded. Sample-by-sample tabular data are available in* Appendix 7.

			KH-P I_{sum}	KH-P I_{max}	KH-P $I_{con-10l}$	KH-P $I_{ub\%}$
		Samples	25	25	25	25
		Volume (l)	248	248	248	248
Wild and weedy plant						
Alismataceae	*Alisma* sp.	seed	—	—	—	—
Apiaceae	Apiaceae s.l.	schizocarp	1	1	0.04	4.00
	Apium -type	schizocarp	—	—	—	—
	Bifora radians	schizocarp	—	—	—	—
	Bupleurum -type	schizocarp	—	—	—	—
	Torilis sp.	schizocarp	—	—	—	—
Asteraceae	Asteraceae s.l.	achene	3	1	0.12	12.00
	Asteraceae s.l.	capitulum	—	—	—	—
	cf Asteraceae s.l.	achene	—	—	—	—
	Artemisia sp.	achene	—	—	—	—
	Artemisia sp. - large capitulum	capitulum	1	1	0.04	4.00
	Artemisia sp. - small capitulum	capitulum	—	—	—	—
	cf *Artemisia* sp.	achene	—	—	—	—
	Aster-type	achene	—	—	—	—
	cf *Aster-type*	achene	—	—	—	—
	Calendula sp.	achene	—	—	—	—
	Carduus nutans-type	achene	—	—	—	—
	Centaurea sp.	achene	9	4	0.36	16.00
	Cichorium sp.	achene	—	—	—	—
	Crepis- type	achene	—	—	—	—
	Onopordum sp.	achene	1	1	0.04	4.00
	Scorzonera sp.	achene	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	—	—	—	—
	Boraginaceae s.l.	endosperm	—	—	—	—
	Buglossoides tenuiflora	nutlet	—	—	—	—
	Buglossoides arvensis /Arnebia decumbens	nutlet	5	2	0.20	16.00
	Echium sp.	nutlet	801	793	32.30	24.00
	Heliotropium sp.	nutlet	7	3	0.28	16.00
	Onosma sp.	nutlet	7	7	0.28	4.00
	Symphytum- type	nutlet	—	—	—	—
Brassicaceae	Brassicaceae s.l.	seed	27	7	1.09	36.00
	Brassicaceae s.l.	silique	—	—	—	—
	Alyssum- type	seed	—	—	—	—
	Alyssum /Lepidium	seed	—	—	—	—
	Brassica- type	seed	2	2	0.08	4.00
	cf *Brassica* -type	seed	—	—	—	—
	Camelina-type	seed	—	—	—	—
	Cardaria draba	seed	2	2	0.08	4.00
	Conringia-type	seed	—	—	—	—
	Descurania-type	seed	—	—	—	—
	Euclidum syriacum	silicle	1	1	0.04	4.00
	Lepidium sp.	seed	3	3	0.12	4.00
	Lepidium sp.	silicle	—	—	—	—
	Lepidium perfoliatum	seed	13	13	0.52	4.00
	Neslia paniculata	silicle	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	seed	1	1	0.04	4.00
	Buffonia sp.	seed	—	—	—	—
	Silene /Stellaria	seed	—	—	—	—
	Silene sp.	seed	3	1	0.12	12.00
	cf *Silene* sp.	seed	—	—	—	—
	Gypsophila sp.	seed	—	—	—	—
	Vaccaria pyramidata	seed	11	6	0.44	20.00
Chenopodiaceae	Chenopodiaceae s.l.	seed	76	34	3.06	36.00
	Atriplex sp.	bract	1	1	0.04	4.00
	Atriplex sp.	seed	23	17	0.93	8.00
	Beta sp.	seed	—	—	—	—
	Chenopodium murale- type	seed	1	1	0.04	4.00
	Chenopodium sp.	seed	314	134	12.66	60.00
	Salsola sp.	seed	26	15	1.05	24.00
	Suaeda sp.	seed	44	14	1.77	52.00
Cistaceae	*Helianthemum* sp.	seed	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	seed	—	—	—	—
Cupressaceae	*Juniperus* sp.	leaf	—	—	—	—
Cyperaceae	Cyperaceae s.l.	achene	13	5	0.52	24.00
	Cyperaceae s.l.	endosperm	31	8	1.25	40.00
	Bolboschoenus glaucus	achene	6	5	0.24	8.00

			KH-P I_{sum}	KH-P I_{max}	KH-P $I_{con-10l}$	KH-P $I_{ub\%}$
		Samples	25	25	25	25
		Volume (l)	248	248	248	248
	Bolboschoenus sp.	achene	—	—	—	—
	Carex spp. (flattened)	achene	92	48	3.71	48.00
	Carex spp. (trigonous)	achene	6	3	0.24	12.00
	Cyperus sp.	achene	—	—	—	—
	Cyperus longus- type	achene	—	—	—	—
	Eleocharis sp.-type 1	achene	—	—	—	—
	Eleocharis sp.-type 2	achene	—	—	—	—
	Fimbristylis sp.	achene	—	—	—	—
	Scirpoides holoschoenus	achene	—	—	—	—
–	Cyperaceae/Polygonaceae	achene	3	2	0.12	8.00
	Cyperaceae/Polygonaceae	endosperm	3	2	0.12	8.00
Dipsacaceae	*Dipsacus* /*Cephalaria*	achene	—	—	—	—
	Dipsacus -type	achene	—	—	—	—
	Cephalaria -type	achene	—	—	—	—
	Scabiosa sp.	achene	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	seed	1	1	0.04	4.00
	Euphorbia taurinensis -type	seed	1	1	0.04	4.00
Fabaceae	Fabaceae s.l.	seed	3	1	0.12	12.00
	Fabaceae s.l.	pod	1	1	0.04	4.00
	Trifolieae s.l.	seed	114	55	4.60	56.00
	Trifolieae s.l.	pod	—	—	—	—
	Astragalus- type	seed	6	4	0.24	12.00
	Medicago radiata	seed	—	—	—	—
	Medicago sp.	pod	—	—	—	—
	Medicago- type	seed	9	5	0.36	12.00
	Melilotus- type	seed	91	50	3.67	44.00
	Trifolium- type	seed	61	28	2.46	20.00
	Trigonella- type	seed	173	163	6.98	20.00
	Coronilla-type	seed	—	—	—	—
Lamiaceae	Lamiaceae s.l.	nutlet	1	1	0.04	4.00
	Ajuga chamaepitys	nutlet	—	—	—	—
	Ajuga- type	nutlet	17	12	0.69	16.00
	Lallemianta -type	nutlet	—	—	—	—
	Menta sp.	nutlet	—	—	—	—
	Nepeta sp.	nutlet	2	2	0.08	4.00
	cf *Nepeta* sp.	nutlet	—	—	—	—
	Stachys- type	nutlet	—	—	—	—
	Teucrium -type	nutlet	2	1	0.08	8.00
	Ziziphora sp.	nutlet	1	1	0.04	4.00
Liliaceae	Liliaceae s.l.	seed	—	—	—	—
	Allium -type	bulbile	—	—	—	—
	Bellevalia sp.	seed	1	1	0.04	4.00
	Ornithogalum sp.	seed	—	—	—	—
Malvaceae	*Malva* sp.	seed	9	8	0.36	8.00
Papaveraceae	*Fumaria* sp.	fruit	2	1	0.08	8.00
	Glaucium sp.	seed	1	1	0.04	4.00
	Papaver sp.	seed	1	1	0.04	4.00
Pinaceae	*Abies* sp.	needle	—	—	—	—
Plantaginaceae	*Plantago* sp.	seed	6	2	0.24	16.00
Poaceae	Poaceae s.l.	caryopsis	83	34	3.35	52.00
	Poaceae s.l.	rachis internode	1	1	0.04	4.00
	Poaceae s.l.	glume	—	—	—	—
	Poaceae s.l.	awn	—	—	—	—
	Aegilops sp.	caryopsis	—	—	—	—
	Aegilops sp.	glume base	—	—	—	—
	Bromus sp.	caryopsis	37	25	1.49	20.00
	Eremopyrum sp.	caryopsis	2	2	0.08	4.00
	Festuca- type	caryopsis	—	—	—	—
	Hordeum sp. (wild)	caryopsis	1	1	0.04	4.00
	Hordeum sp. (wild)	rachis internode	2	2	0.08	4.00
	Lolium sp.	caryopsis	5	5	0.20	4.00
	Micropyrum -type	caryopsis	—	—	—	—
	Phalaris sp.	caryopsis	12	10	0.48	12.00
	Poa bulbosa	floret	—	—	—	—
	Setaria viridis /*verticillata* -type	caryopsis	—	—	—	—
	Stipa sp.	caryopsis	—	—	—	—
	Taeniatherum caput-medusae	glume base	1	1	0.04	4.00

			KH-P I_{sum}	KH-P I_{max}	KH-P $I_{con-10l}$	KH-P $I_{ub\%}$
		Samples	25	25	25	25
		Volume (l)	248	248	248	248
Polygonaceae	Polygonaceae s.l.	achene	17	7	0.69	24.00
	Polygonaceae s.l.	endosperm	—	—	—	—
	Persicaria -type	achene	3	1	0.12	12.00
	Polygonum sp.	achene	—	—	—	—
	Polygonum convolvulus	achene	—	—	—	—
	Polygonum aviculare s.l.	achene	6	3	0.24	16.00
	Rumex sp.	achene	4	1	0.16	16.00
Portulacaceae	*Portulaca oleracea*	seed	7	4	0.28	16.00
Potamogetonaceae	*Potamogeton* sp.	fruit	—	—	—	—
Primulaceae	*Androsace maxima*	seed	6	5	0.24	8.00
	cf *Androsace* sp.	seed	—	—	—	—
Ranunculaceae	*Adonis* sp.	achene	2	1	0.08	8.00
	Ceratocephalus falcatus	achene	—	—	—	—
	Ranunculus sp.	achene	—	—	—	—
Resedaceae	*Reseda lutea* -type	seed	23	18	0.93	16.00
Rosaceae	*Sanguisorba* sp.	fruit	—	—	—	—
Rubiaceae	Rubiaceae-type 1	fruit	—	—	—	—
	Galium /Asperula	fruit	1	1	0.04	4.00
	Asperula arvensis /orientalis	fruit	67	39	2.70	16.00
	Asperula sp.	fruit	1	1	0.04	4.00
	Galium sp.	fruit	25	12	1.01	36.00
Scrophulariaceae	*Scrophularia /Verbascum*	seed	5	3	0.20	12.00
	Veronica sp.	seed	1	1	0.04	4.00
	Veronica dillenii-type	seed	—	—	—	—
	Veronica hederifolia	seed	—	—	—	—
	Veronica polita -type	seed	3	2	0.12	8.00
	Veronica triphyllos	seed	—	—	—	—
Solanaceae	Solanaceae s.l.	seed	7	7	0.28	4.00
	Hyoscyamus sp.	seed	20	10	0.81	28.00
	Solanum sp.	seed	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	achene	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	achene	—	—	—	—
	Valerianella vesicaria- type	achene	—	—	—	—
Zygophillaceae	*Peganum harmala*	seed	—	—	—	—

Table 6.16 – *Wild and weedy taxa found in samples from period KH-P I: sum= absolute count; max= maximum count value in a single sample; con-10l= concentration expressed with a standard value of 10 liters; ub%= ubiquity (percentage of samples in which the taxon is found).*

			KH-P IIA$_{sum}$	KH-P IIA$_{max}$	KH-P IIA$_{con\text{-}10l}$	KH-P IIA$_{ub\%}$
		Samples	2	2	2	2
		Volume (l)	19	19	19	19
Wild and weedy plant						
Alismataceae	*Alisma* sp.	seed	—	—	—	—
Apiaceae	Apiaceae s.l.	schizocarp	—	—	—	—
	Apium -type	schizocarp	—	—	—	—
	Bifora radians	schizocarp	—	—	—	—
	Bupleurum -type	schizocarp	—	—	—	—
	Torilis sp.	schizocarp	—	—	—	—
Asteraceae	Asteraceae s.l.	achene	—	—	—	—
	Asteraceae s.l.	capitulum	—	—	—	—
	cf Asteraceae s.l.	achene	—	—	—	—
	Artemisia sp.	achene	—	—	—	—
	Artemisia sp. - large capitulum	capitulum	—	—	—	—
	Artemisia sp. - small capitulum	capitulum	—	—	—	—
	cf *Artemisia* sp.	achene	—	—	—	—
	Aster-type	achene	—	—	—	—
	cf *Aster-type*	achene	—	—	—	—
	Calendula sp.	achene	—	—	—	—
	Carduus nutans-type	achene	—	—	—	—
	Centaurea sp.	achene	—	—	—	—
	Cichorium sp.	achene	—	—	—	—
	Crepis- type	achene	—	—	—	—
	Onopordum sp.	achene	—	—	—	—
	Scorzonera sp.	achene	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	—	—	—	—
	Boraginaceae s.l.	endosperm	—	—	—	—
	Buglossoides tenuiflora	nutlet	—	—	—	—
	Buglossoides arvensis /Arnebia decumbens	nutlet	—	—	—	—
	Echium sp.	nutlet	—	—	—	—
	Heliotropium sp.	nutlet	—	—	—	—
	Onosma sp.	nutlet	—	—	—	—
	Symphytum- type	nutlet	—	—	—	—
Brassicaceae	Brassicaceae s.l.	seed	—	—	—	—
	Brassicaceae s.l.	silique	—	—	—	—
	Alyssum- type	seed	—	—	—	—
	Alyssum /Lepidium	seed	—	—	—	—
	Brassica- type	seed	—	—	—	—
	cf *Brassica* -type	seed	—	—	—	—
	Camelina-type	seed	—	—	—	—
	Cardaria draba	seed	—	—	—	—
	Conringia-type	seed	—	—	—	—
	Descurania-type	seed	—	—	—	—
	Euclidum syriacum	silicle	—	—	—	—
	Lepidium sp.	seed	—	—	—	—
	Lepidium sp.	silicle	—	—	—	—
	Lepidium perfoliatum	seed	—	—	—	—
	Neslia paniculata	silicle	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	seed	—	—	—	—
	Buffonia sp.	seed	—	—	—	—
	Silene /Stellaria	seed	—	—	—	—
	Silene sp.	seed	—	—	—	—
	cf *Silene* sp.	seed	—	—	—	—
	Gypsophila sp.	seed	—	—	—	—
	Vaccaria pyramidata	seed	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	seed	—	—	—	—
	Atriplex sp.	bract	—	—	—	—
	Atriplex sp.	seed	—	—	—	—
	Beta sp.	seed	—	—	—	—
	Chenopodium murale- type	seed	—	—	—	—
	Chenopodium sp.	seed	1	1	0.53	50.00
	Salsola sp.	seed	—	—	—	—
	Suaeda sp.	seed	—	—	—	—
Cistaceae	*Helianthemum* sp.	seed	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	seed	—	—	—	—
Cupressaceae	*Juniperus* sp.	leaf	—	—	—	—
Cyperaceae	Cyperaceae s.l.	achene	—	—	—	—
	Cyperaceae s.l.	endosperm	—	—	—	—
	Bolboschoenus glaucus	achene	—	—	—	—

			KH-P IIA$_{sum}$	KH-P IIA$_{max}$	KH-P IIA$_{con\text{-}10l}$	KH-P IIA$_{ub\%}$
		Samples	2	2	2	2
		Volume (l)	19	19	19	19
	Bolboschoenus sp.	achene	—	—	—	—
	Carex spp. (flattened)	achene	—	—	—	—
	Carex spp. (trigonous)	achene	—	—	—	—
	Cyperus sp.	achene	—	—	—	—
	Cyperus longus- type	achene	—	—	—	—
	Eleocharis sp.-type 1	achene	—	—	—	—
	Eleocharis sp.-type 2	achene	—	—	—	—
	Fimbristylis sp.	achene	—	—	—	—
	Scirpoides holoschoenus	achene	—	—	—	—
–	Cyperaceae/Polygonaceae	achene	—	—	—	—
	Cyperaceae/Polygonaceae	endosperm	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	achene	—	—	—	—
	Dipsacus -type	achene	—	—	—	—
	Cephalaria -type	achene	—	—	—	—
	Scabiosa sp.	achene	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	seed	—	—	—	—
	Euphorbia taurinensis -type	seed	—	—	—	—
Fabaceae	Fabaceae s.l.	seed	—	—	—	—
	Fabaceae s.l.	pod	—	—	—	—
	Trifolieae s.l.	seed	2	2	1.05	50.00
	Trifolieae s.l.	pod	—	—	—	—
	Astragalus- type	seed	—	—	—	—
	Medicago radiata	seed	—	—	—	—
	Medicago sp.	pod	—	—	—	—
	Medicago- type	seed	—	—	—	—
	Melilotus- type	seed	—	—	—	—
	Trifolium- type	seed	—	—	—	—
	Trigonella- type	seed	2	2	1.05	50.00
	Coronilla-type	seed	—	—	—	—
Lamiaceae	Lamiaceae s.l.	nutlet	—	—	—	—
	Ajuga chamaepitys	nutlet	—	—	—	—
	Ajuga- type	nutlet	—	—	—	—
	Lallemianta -type	nutlet	—	—	—	—
	Menta sp.	nutlet	—	—	—	—
	Nepeta sp.	nutlet	—	—	—	—
	cf *Nepeta* sp.	nutlet	—	—	—	—
	Stachys- type	nutlet	—	—	—	—
	Teucrium -type	nutlet	—	—	—	—
	Ziziphora sp.	nutlet	—	—	—	—
Liliaceae	Liliaceae s.l.	seed	—	—	—	—
	Allium -type	bulbile	—	—	—	—
	Bellevalia sp.	seed	—	—	—	—
	Ornithogalum sp.	seed	—	—	—	—
Malvaceae	*Malva* sp.	seed	—	—	—	—
Papaveraceae	*Fumaria* sp.	fruit	—	—	—	—
	Glaucium sp.	seed	—	—	—	—
	Papaver sp.	seed	—	—	—	—
Pinaceae	*Abies* sp.	needle	—	—	—	—
Plantaginaceae	*Plantago* sp.	seed	—	—	—	—
Poaceae	Poaceae s.l.	caryopsis	2	2	1.05	50.00
	Poaceae s.l.	rachis internode	—	—	—	—
	Poaceae s.l.	glume	—	—	—	—
	Poaceae s.l.	awn	—	—	—	—
	Aegilops sp.	caryopsis	—	—	—	—
	Aegilops sp.	glume base	—	—	—	—
	Bromus sp.	caryopsis	—	—	—	—
	Eremopyrum sp.	caryopsis	—	—	—	—
	Festuca- type	caryopsis	—	—	—	—
	Hordeum sp. (wild)	caryopsis	—	—	—	—
	Hordeum sp. (wild)	rachis internode	—	—	—	—
	Lolium sp.	caryopsis	—	—	—	—
	Micropyrum -type	caryopsis	—	—	—	—
	Phalaris sp.	caryopsis	—	—	—	—
	Poa bulbosa	floret	—	—	—	—
	Setaria viridis /verticillata -type	caryopsis	—	—	—	—
	Stipa sp.	caryopsis	—	—	—	—
	Taeniatherum caput-medusae	glume base	—	—	—	—

			KH-P IIA$_{sum}$	KH-P IIA$_{max}$	KH-P IIA$_{con\text{-}10l}$	KH-P IIA$_{ub\%}$
		Samples	2	2	2	2
		Volume (l)	19	19	19	19
Polygonaceae	Polygonaceae s.l.	achene	1	1	0.53	50.00
	Polygonaceae s.l.	endosperm	—	—	—	—
	Persicaria -type	achene	—	—	—	—
	Polygonum sp.	achene	—	—	—	—
	Polygonum convolvulus	achene	—	—	—	—
	Polygonum aviculare s.l.	achene	—	—	—	—
	Rumex sp.	achene	—	—	—	—
Portulacaceae	*Portulaca oleracea*	seed	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	fruit	—	—	—	—
Primulaceae	*Androsace maxima*	seed	—	—	—	—
	cf *Androsace* sp.	seed	—	—	—	—
Ranunculaceae	*Adonis* sp.	achene	1	1	0.53	50.00
	Ceratocephalus falcatus	achene	—	—	—	—
	Ranunculus sp.	achene	—	—	—	—
Resedaceae	*Reseda lutea* -type	seed	—	—	—	—
Rosaceae	*Sanguisorba* sp.	fruit	—	—	—	—
Rubiaceae	Rubiaceae-type 1	fruit	—	—	—	—
	Galium /Asperula	fruit	—	—	—	—
	Asperula arvensis /orientalis	fruit	—	—	—	—
	Asperula sp.	fruit	—	—	—	—
	Galium sp.	fruit	2	2	1.05	50.00
Scrophulariaceae	*Scrophularia /Verbascum*	seed	—	—	—	—
	Veronica sp.	seed	—	—	—	—
	Veronica dillenii-type	seed	—	—	—	—
	Veronica hederifolia	seed	—	—	—	—
	Veronica polita -type	seed	—	—	—	—
	Veronica triphyllos	seed	—	—	—	—
Solanaceae	Solanaceae s.l.	seed	—	—	—	—
	Hyoscyamus sp.	seed	1	1	0.53	50.00
	Solanum sp.	seed	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	achene	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	achene	—	—	—	—
	Valerianella vesicaria- type	achene	—	—	—	—
Zygophillaceae	*Peganum harmala*	seed	—	—	—	—

Table 6.17 – *Wild and weedy taxa found in samples from period KH-P IIA: sum= absolute count; max= maximum count value in a single sample; con-10l= concentration expressed with a standard value of 10 liters; ub%= ubiquity (percentage of samples in which the taxon is found).*

			KH-P IIB$_{sum}$	KH-P IIB$_{max}$	KH-P IIB$_{con-10l}$	KH-P IIB$_{ub\%}$
		Samples	39	39	39	39
		Volume (l)	385.7	385.7	385.7	385.7
Wild and weedy plant						
Alismataceae	*Alisma* sp.	seed	23	21	0.60	5.13
Apiaceae	Apiaceae s.l.	schizocarp	95	53	2.46	28.21
	Apium -type	schizocarp	4	3	0.10	5.13
	Bifora radians	schizocarp	—	—	—	—
	Bupleurum -type	schizocarp	—	—	—	—
	Torilis sp.	schizocarp	2	1	0.05	5.13
Asteraceae	Asteraceae s.l.	achene	31	8	0.80	38.46
	Asteraceae s.l.	capitulum	2	1	0.05	5.13
	cf Asteraceae s.l.	achene	2	1	0.05	5.13
	Artemisia sp.	achene	3	2	0.08	5.13
	Artemisia sp. - large capitulum	capitulum	—	—	—	—
	Artemisia sp. - small capitulum	capitulum	—	—	—	—
	cf *Artemisia* sp.	achene	—	—	—	—
	Aster-type	achene	—	—	—	—
	cf *Aster-type*	achene	—	—	—	—
	Calendula sp.	achene	1	1	0.03	2.56
	Carduus nutans-type	achene	6	6	0.16	2.56
	Centaurea sp.	achene	15	4	0.39	25.64
	Cichorium sp.	achene	—	—	—	—
	Crepis- type	achene	1	1	0.03	2.56
	Onopordum sp.	achene	2	1	0.05	5.13
	Scorzonera sp.	achene	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	—	—	—	—
	Boraginaceae s.l.	endosperm	1	1	0.03	2.56
	Buglossoides tenuiflora	nutlet	2	1	0.05	5.13
	Buglossoides arvensis /Arnebia decumbens	nutlet	48	12	1.24	43.59
	Echium sp.	nutlet	51	41	1.32	12.82
	Heliotropium sp.	nutlet	10	7	0.26	5.13
	Onosma sp.	nutlet	1	1	0.03	2.56
	Symphytum- type	nutlet	—	—	—	—
Brassicaceae	Brassicaceae s.l.	seed	71	16	1.84	38.46
	Brassicaceae s.l.	silique	—	—	—	—
	Alyssum- type	seed	1	1	0.03	2.56
	Alyssum /Lepidium	seed	—	—	—	—
	Brassica- type	seed	23	11	0.60	10.26
	cf *Brassica* -type	seed	—	—	—	—
	Camelina-type	seed	—	—	—	—
	Cardaria draba	seed	—	—	—	—
	Conringia-type	seed	—	—	—	—
	Descurania-type	seed	11	8	0.29	5.13
	Euclidum syriacum	silicle	13	9	0.34	12.82
	Lepidium sp.	seed	3	2	0.08	5.13
	Lepidium sp.	silicle	—	—	—	—
	Lepidium perfoliatum	seed	118	83	3.06	10.26
	Neslia paniculata	silicle	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	seed	1	1	0.03	2.56
	Buffonia sp.	seed	1	1	0.03	2.56
	Silene /Stellaria	seed	—	—	—	—
	Silene sp.	seed	7	4	0.18	10.26
	cf *Silene* sp.	seed	—	—	—	—
	Gypsophila sp.	seed	2	1	0.05	5.13
	Vaccaria pyramidata	seed	38	21	0.99	28.21
Chenopodiaceae	Chenopodiaceae s.l.	seed	133	42	3.45	53.85
	Atriplex sp.	bract	11	7	0.29	5.13
	Atriplex sp.	seed	437	309	11.33	38.46
	Beta sp.	seed	2	2	0.05	2.56
	Chenopodium murale- type	seed	9	9	0.23	2.56
	Chenopodium sp.	seed	236	120	6.12	43.59
	Salsola sp.	seed	217	142	5.63	38.46
	Suaeda sp.	seed	121	37	3.14	69.23
Cistaceae	*Helianthemum* sp.	seed	2	2	0.05	2.56
Convolvulaceae	*Convolvulus* sp.	seed	1	1	0.03	2.56
Cupressaceae	*Juniperus* sp.	leaf	—	—	—	—
Cyperaceae	Cyperaceae s.l.	achene	140	104	3.63	48.72
	Cyperaceae s.l.	endosperm	146	110	3.79	33.33
	Bolboschoenus glaucus	achene	16	2	0.41	33.33

			KH-P IIB$_{sum}$	KH-P IIB$_{max}$	KH-P IIB$_{con-10l}$	KH-P IIB$_{ub\%}$
		Samples	39	39	39	39
		Volume (l)	385.7	385.7	385.7	385.7
	Bolboschoenus sp.	achene	3	1	0.08	7.69
	Carex spp. (flattened)	achene	225	37	5.83	79.49
	Carex spp. (trigonous)	achene	48	31	1.24	25.64
	Cyperus sp.	achene	1	1	0.03	2.56
	Cyperus longus- type	achene	1	1	0.03	2.56
	Eleocharis sp.-type 1	achene	13	7	0.34	12.82
	Eleocharis sp.-type 2	achene	379	356	9.83	15.38
	Fimbristylis sp.	achene	4	2	0.10	7.69
	Scirpoides holoschoenus	achene	—	—	—	—
–	Cyperaceae/Polygonaceae	achene	5	3	0.13	5.13
	Cyperaceae/Polygonaceae	endosperm	9	3	0.23	10.26
Dipsacaceae	*Dipsacus* /*Cephalaria*	achene	—	—	—	—
	Dipsacus -type	achene	—	—	—	—
	Cephalaria -type	achene	3	2	0.08	5.13
	Scabiosa sp.	achene	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	seed	—	—	—	—
	Euphorbia taurinensis -type	seed	1	1	0.03	2.56
Fabaceae	Fabaceae s.l.	seed	4	2	0.10	7.69
	Fabaceae s.l.	pod	2	2	0.05	2.56
	Trifolieae s.l.	seed	150	20	3.89	76.92
	Trifolieae s.l.	pod	—	—	—	—
	Astragalus- type	seed	14	6	0.36	12.82
	Medicago radiata	seed	—	—	—	—
	Medicago sp.	pod	2	2	0.05	2.56
	Medicago- type	seed	91	20	2.36	43.59
	Melilotus- type	seed	205	70	5.32	46.15
	Trifolium- type	seed	97	33	2.51	41.03
	Trigonella- type	seed	89	64	2.31	28.21
	Coronilla-type	seed	1	1	0.03	2.56
Lamiaceae	Lamiaceae s.l.	nutlet	3	2	0.08	5.13
	Ajuga chamaepitys	nutlet	1	1	0.03	2.56
	Ajuga- type	nutlet	24	10	0.62	28.21
	Lallemianta -type	nutlet	—	—	—	—
	Menta sp.	nutlet	—	—	—	—
	Nepeta sp.	nutlet	4	1	0.10	10.26
	cf *Nepeta* sp.	nutlet	—	—	—	—
	Stachys- type	nutlet	2	1	0.05	5.13
	Teucrium -type	nutlet	—	—	—	—
	Ziziphora sp.	nutlet	9	5	0.23	12.82
Liliaceae	Liliaceae s.l.	seed	1	1	0.03	2.56
	Allium -type	bulbile	5	3	0.13	7.69
	Bellevalia sp.	seed	5	1	0.13	12.82
	Ornithogalum sp.	seed	8	6	0.21	7.69
Malvaceae	*Malva* sp.	seed	2	1	0.05	5.13
Papaveraceae	*Fumaria* sp.	fruit	31	29	0.80	7.69
	Glaucium sp.	seed	14	7	0.36	10.26
	Papaver sp.	seed	9	6	0.23	7.69
Pinaceae	*Abies* sp.	needle	19	18	0.49	5.13
Plantaginaceae	*Plantago* sp.	seed	9	4	0.23	10.26
Poaceae	Poaceae s.l.	caryopsis	848	555	21.99	82.05
	Poaceae s.l.	rachis internode	14	4	0.36	20.51
	Poaceae s.l.	glume	2	2	0.05	2.56
	Poaceae s.l.	awn	—	—	—	—
	Aegilops sp.	caryopsis	—	—	—	—
	Aegilops sp.	glume base	7	3	0.18	12.82
	Bromus sp.	caryopsis	26	6	0.67	28.21
	Eremopyrum sp.	caryopsis	2	1	0.05	5.13
	Festuca- type	caryopsis	—	—	—	—
	Hordeum sp. (wild)	caryopsis	143	134	3.71	20.51
	Hordeum sp. (wild)	rachis internode	9	9	0.23	2.56
	Lolium sp.	caryopsis	2	1	0.05	5.13
	Micropyrum -type	caryopsis	1	1	0.03	2.56
	Phalaris sp.	caryopsis	5	4	0.13	5.13
	Poa bulbosa	floret	5	3	0.13	5.13
	Setaria viridis /*verticillata* -type	caryopsis	—	—	—	—
	Stipa sp.	caryopsis	13	3	0.34	23.08
	Taeniatherum caput-medusae	glume base	—	—	—	—

			KH-P IIB$_{sum}$	KH-P IIB$_{max}$	KH-P IIB$_{con-10l}$	KH-P IIB$_{ub\%}$
		Samples	39	39	39	39
		Volume (l)	385.7	385.7	385.7	385.7
Polygonaceae	Polygonaceae s.l.	achene	47	11	1.22	28.21
	Polygonaceae s.l.	endosperm	2	2	0.05	2.56
	Persicaria -type	achene	1	1	0.03	2.56
	Polygonum sp.	achene	9	5	0.23	7.69
	Polygonum convolvulus	achene	—	—	—	—
	Polygonum aviculare s.l.	achene	18	4	0.47	23.08
	Rumex sp.	achene	82	34	2.13	38.46
Portulacaceae	*Portulaca oleracea*	seed	3	2	0.08	5.13
Potamogetonaceae	*Potamogeton* sp.	fruit	1	1	0.03	2.56
Primulaceae	*Androsace maxima*	seed	16	7	0.41	20.51
	cf *Androsace* sp.	seed	—	—	—	—
Ranunculaceae	*Adonis* sp.	achene	12	3	0.31	20.51
	Ceratocephalus falcatus	achene	—	—	—	—
	Ranunculus sp.	achene	—	—	—	—
Resedaceae	*Reseda lutea* -type	seed	8	6	0.21	5.13
Rosaceae	*Sanguisorba* sp.	fruit	—	—	—	—
Rubiaceae	Rubiaceae-type 1	fruit	2126	1801	55.12	5.13
	Galium /Asperula	fruit	—	—	—	—
	Asperula arvensis /orientalis	fruit	11	3	0.29	12.82
	Asperula sp.	fruit	1	1	0.03	2.56
	Galium sp.	fruit	85	25	2.20	58.97
Scrophulariaceae	*Scrophularia /Verbascum*	seed	4	2	0.10	7.69
	Veronica sp.	seed	—	—	—	—
	Veronica dillenii-type	seed	1	1	0.03	2.56
	Veronica hederifolia	seed	—	—	—	—
	Veronica polita -type	seed	2	1	0.05	5.13
	Veronica triphyllos	seed	1	1	0.03	2.56
Solanaceae	Solanaceae s.l.	seed	5	3	0.13	7.69
	Hyoscyamus sp.	seed	73	11	1.89	53.85
	Solanum sp.	seed	4	4	0.10	2.56
Thymelaeaceae	*Thymelaea* sp.	achene	1	1	0.03	2.56
Valerianaceae	*Valerianella coronata-* type	achene	15	8	0.39	15.38
	Valerianella vesicaria- type	achene	—	—	—	—
Zygophillaceae	*Peganum harmala*	seed	1	1	0.03	2.56

Table 6.18 – *Wild and weedy taxa found in samples from period KH-P IIB: sum= absolute count; max= maximum count value in a single sample; con-10l= concentration expressed with a standard value of 10 liters; ub%= ubiquity (percentage of samples in which the taxon is found).*

			KH-P III$_{sum}$	KH-P III$_{max}$	KH-P III$_{con\text{-}10l}$	KH-P III$_{ub\%}$
		Samples	56	56	56	56
		Volume (l)	667.2	667.2	667.2	667.2
Wild and weedy plant						
Alismataceae	*Alisma* sp.	seed	75	72	1.12	7.14
Apiaceae	Apiaceae s.l.	schizocarp	32	14	0.48	16.07
	Apium -type	schizocarp	—	—	—	—
	Bifora radians	schizocarp	—	—	—	—
	Bupleurum -type	schizocarp	2	1	0.03	3.57
	Torilis sp.	schizocarp	—	—	—	—
Asteraceae	Asteraceae s.l.	achene	18	6	0.27	14.29
	Asteraceae s.l.	capitulum	6	4	0.09	5.36
	cf Asteraceae s.l.	achene	—	—	—	—
	Artemisia sp.	achene	61	38	0.91	7.14
	Artemisia sp. - large capitulum	capitulum	2	1	0.03	3.57
	Artemisia sp. - small capitulum	capitulum	—	—	—	—
	cf *Artemisia* sp.	achene	—	—	—	—
	Aster-type	achene	3	1	0.04	5.36
	cf *Aster-type*	achene	—	—	—	—
	Calendula sp.	achene	—	—	—	—
	Carduus nutans-type	achene	—	—	—	—
	Centaurea sp.	achene	16	4	0.24	12.50
	Cichorium sp.	achene	—	—	—	—
	Crepis- type	achene	—	—	—	—
	Onopordum sp.	achene	37	16	0.55	16.07
	Scorzonera sp.	achene	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	2	1	0.03	3.57
	Boraginaceae s.l.	endosperm	1	1	0.01	1.79
	Buglossoides tenuiflora	nutlet	1	1	0.01	1.79
	Buglossoides arvensis /Arnebia decumbens	nutlet	498	195	7.46	69.64
	Echium sp.	nutlet	119	37	1.78	23.21
	Heliotropium sp.	nutlet	29	14	0.43	21.43
	Onosma sp.	nutlet	1	1	0.01	1.79
	Symphytum- type	nutlet	—	—	—	—
Brassicaceae	Brassicaceae s.l.	seed	159	67	2.38	55.36
	Brassicaceae s.l.	silique	3	2	0.04	3.57
	Alyssum- type	seed	7	5	0.10	5.36
	Alyssum /Lepidium	seed	4	4	0.06	1.79
	Brassica- type	seed	6	3	0.09	7.14
	cf *Brassica* -type	seed	3	3	0.04	1.79
	Camelina-type	seed	—	—	—	—
	Cardaria draba	seed	5	2	0.07	5.36
	Conringia-type	seed	—	—	—	—
	Descurania-type	seed	—	—	—	—
	Euclidum syriacum	silicle	21	6	0.31	21.43
	Lepidium sp.	seed	1	1	0.01	1.79
	Lepidium sp.	silicle	—	—	—	—
	Lepidium perfoliatum	seed	3	1	0.04	5.36
	Neslia paniculata	silicle	1	1	0.01	1.79
Caryophyllaceae	Caryophillaceae s.l.	seed	4	2	0.06	5.36
	Buffonia sp.	seed	1	1	0.01	1.79
	Silene /Stellaria	seed	3	3	0.04	1.79
	Silene sp.	seed	11	5	0.16	12.50
	cf *Silene* sp.	seed	3	1	0.04	5.36
	Gypsophila sp.	seed	8	4	0.12	7.14
	Vaccaria pyramidata	seed	66	19	0.99	33.93
Chenopodiaceae	Chenopodiaceae s.l.	seed	99	16	1.48	41.07
	Atriplex sp.	bract	1	1	0.01	1.79
	Atriplex sp.	seed	117	75	1.75	21.43
	Beta sp.	seed	—	—	—	—
	Chenopodium murale- type	seed	5	3	0.07	3.57
	Chenopodium sp.	seed	256	28	3.84	60.71
	Salsola sp.	seed	94	18	1.41	39.29
	Suaeda sp.	seed	2081	1287	31.19	78.57
Cistaceae	*Helianthemum* sp.	seed	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	seed	1	1	0.01	1.79
Cupressaceae	*Juniperus* sp.	leaf	9	4	0.13	7.14
Cyperaceae	Cyperaceae s.l.	achene	143	26	2.14	55.36
	Cyperaceae s.l.	endosperm	393	241	5.89	50.00
	Bolboschoenus glaucus	achene	31	5	0.46	35.71

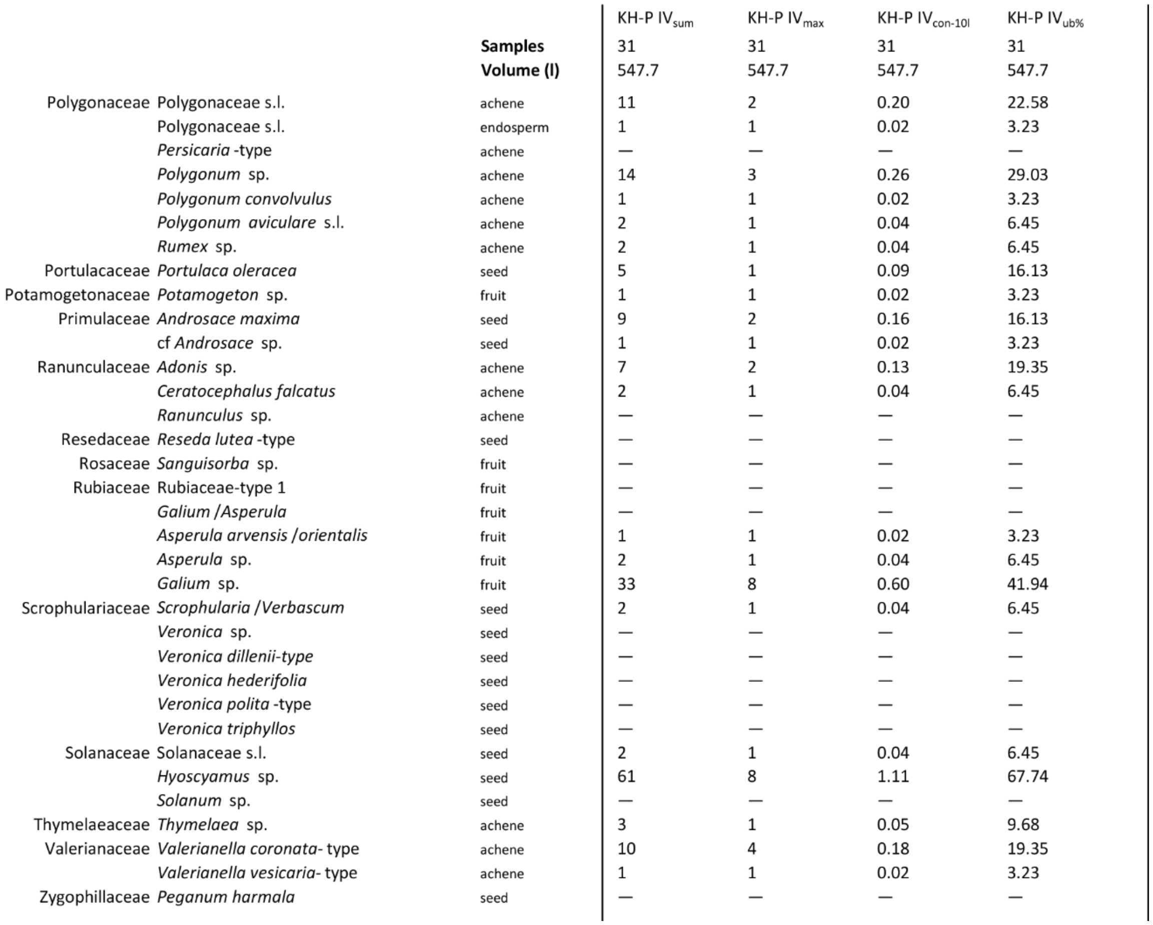
			KH-P III$_{sum}$	KH-P III$_{max}$	KH-P III$_{con\text{-}10l}$	KH-P III$_{ub\%}$
		Samples	56	56	56	56
		Volume (l)	667.2	667.2	667.2	667.2
	Bolboschoenus sp.	achene	5	3	0.07	5.36
	Carex spp. (flattened)	achene	1797	707	26.93	82.14
	Carex spp. (trigonous)	achene	30	7	0.45	23.21
	Cyperus sp.	achene	—	—	—	—
	Cyperus longus- type	achene	1	1	0.01	1.79
	Eleocharis sp.-type 1	achene	76	22	1.14	37.50
	Eleocharis sp.-type 2	achene	25	9	0.37	14.29
	Fimbristylis sp.	achene	25	9	0.37	12.50
	Scirpoides holoschoenus	achene	5	5	0.07	1.79
–	Cyperaceae/Polygonaceae	achene	34	19	0.51	14.29
	Cyperaceae/Polygonaceae	endosperm	21	4	0.31	21.43
Dipsacaceae	*Dipsacus* /*Cephalaria*	achene	1	1	0.01	1.79
	Dipsacus -type	achene	1	1	0.01	1.79
	Cephalaria -type	achene	1	1	0.01	1.79
	Scabiosa sp.	achene	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	seed	—	—	—	—
	Euphorbia taurinensis -type	seed	1	1	0.01	1.79
Fabaceae	Fabaceae s.l.	seed	16	10	0.24	10.71
	Fabaceae s.l.	pod	—	—	—	—
	Trifolieae s.l.	seed	264	114	3.96	53.57
	Trifolieae s.l.	pod	2	2	0.03	1.79
	Astragalus- type	seed	21	8	0.31	16.07
	Medicago radiata	seed	1	1	0.01	1.79
	Medicago sp.	pod	2	2	0.03	1.79
	Medicago- type	seed	174	31	2.61	55.36
	Melilotus- type	seed	509	63	7.63	73.21
	Trifolium- type	seed	452	204	6.77	60.71
	Trigonella- type	seed	190	62	2.85	55.36
	Coronilla-type	seed	3	3	0.04	1.79
Lamiaceae	Lamiaceae s.l.	nutlet	5	1	0.07	8.93
	Ajuga chamaepitys	nutlet	—	—	—	—
	Ajuga- type	nutlet	20	3	0.30	21.43
	Lallemianta -type	nutlet	1	1	0.01	1.79
	Menta sp.	nutlet	—	—	—	—
	Nepeta sp.	nutlet	9	2	0.13	10.71
	cf *Nepeta* sp.	nutlet	1	1	0.01	1.79
	Stachys- type	nutlet	1	1	0.01	1.79
	Teucrium -type	nutlet	2	1	0.03	3.57
	Ziziphora sp.	nutlet	21	5	0.31	21.43
Liliaceae	Liliaceae s.l.	seed	—	—	—	—
	Allium -type	bulbile	10	5	0.15	8.93
	Bellevalia sp.	seed	21	13	0.31	10.71
	Ornithogalum sp.	seed	7	2	0.10	8.93
Malvaceae	*Malva* sp.	seed	20	12	0.30	14.29
Papaveraceae	*Fumaria* sp.	fruit	14	2	0.21	21.43
	Glaucium sp.	seed	23	16	0.34	12.50
	Papaver sp.	seed	3	2	0.04	3.57
Pinaceae	*Abies* sp.	needle	—	—	—	—
Plantaginaceae	*Plantago* sp.	seed	18	8	0.27	12.50
Poaceae	Poaceae s.l.	caryopsis	1075	544	16.11	76.79
	Poaceae s.l.	rachis internode	7	1	0.10	12.50
	Poaceae s.l.	glume	4	3	0.06	3.57
	Poaceae s.l.	awn	8	4	0.12	5.36
	Aegilops sp.	caryopsis	—	—	—	—
	Aegilops sp.	glume base	—	—	—	—
	Bromus sp.	caryopsis	125	79	1.87	33.93
	Eremopyrum sp.	caryopsis	25	11	0.37	12.50
	Festuca- type	caryopsis	20	14	0.30	10.71
	Hordeum sp. (wild)	caryopsis	25	10	0.37	17.86
	Hordeum sp. (wild)	rachis internode	2	1	0.03	3.57
	Lolium sp.	caryopsis	3	1	0.04	5.36
	Micropyrum -type	caryopsis	—	—	—	—
	Phalaris sp.	caryopsis	30	26	0.45	7.14
	Poa bulbosa	floret	12	6	0.18	7.14
	Setaria viridis /*verticillata* -type	caryopsis	1	1	0.01	1.79
	Stipa sp.	caryopsis	22	7	0.33	21.43
	Taeniatherum caput-medusae	glume base	—	—	—	—

			KH-P III$_{sum}$	KH-P III$_{max}$	KH-P III$_{con-10l}$	KH-P III$_{ub\%}$
		Samples	56	56	56	56
		Volume (l)	667.2	667.2	667.2	667.2
Polygonaceae	Polygonaceae s.l.	achene	58	9	0.87	30.36
	Polygonaceae s.l.	endosperm	1	1	0.01	1.79
	Persicaria -type	achene	1	1	0.01	1.79
	Polygonum sp.	achene	56	35	0.84	16.07
	Polygonum convolvulus	achene	9	3	0.13	7.14
	Polygonum aviculare s.l.	achene	43	14	0.64	25.00
	Rumex sp.	achene	41	13	0.61	21.43
Portulacaceae	*Portulaca oleracea*	seed	7	5	0.10	5.36
Potamogetonaceae	*Potamogeton* sp.	fruit	—	—	—	—
Primulaceae	*Androsace maxima*	seed	27	4	0.40	30.36
	cf *Androsace* sp.	seed	—	—	—	—
Ranunculaceae	*Adonis* sp.	achene	50	22	0.75	33.93
	Ceratocephalus falcatus	achene	14	2	0.21	19.64
	Ranunculus sp.	achene	3	1	0.04	5.36
Resedaceae	*Reseda lutea* -type	seed	—	—	—	—
Rosaceae	*Sanguisorba* sp.	fruit	2	2	0.03	1.79
Rubiaceae	Rubiaceae-type 1	fruit	—	—	—	—
	Galium /Asperula	fruit	—	—	—	—
	Asperula arvensis /orientalis	fruit	10	2	0.15	14.29
	Asperula sp.	fruit	7	2	0.10	7.14
	Galium sp.	fruit	102	14	1.53	48.21
Scrophulariaceae	*Scrophularia /Verbascum*	seed	10	3	0.15	14.29
	Veronica sp.	seed	1	1	0.01	1.79
	Veronica dillenii-type	seed	2	1	0.03	3.57
	Veronica hederifolia	seed	1	1	0.01	1.79
	Veronica polita -type	seed	4	2	0.06	3.57
	Veronica triphyllos	seed	—	—	—	—
Solanaceae	Solanaceae s.l.	seed	1	1	0.01	1.79
	Hyoscyamus sp.	seed	198	25	2.97	55.36
	Solanum sp.	seed	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	achene	2	1	0.03	3.57
Valerianaceae	*Valerianella coronata*- type	achene	41	20	0.61	25.00
	Valerianella vesicaria- type	achene	—	—	—	—
Zygophillaceae	*Peganum harmala*	seed	—	—	—	—

Table 6.19 – *Wild and weedy taxa found in samples from period KH-P III: sum= absolute count; max= maximum count value in a single sample; con-10l= concentration expressed with a standard value of 10 liters; ub%= ubiquity (percentage of samples in which the taxon is found).*

			KH-P IV_{sum}	KH-P IV_{max}	KH-P $IV_{con-10l}$	KH-P $IV_{ub\%}$
		Samples	31	31	31	31
		Volume (l)	547.7	547.7	547.7	547.7
Wild and weedy plant						
Alismataceae	*Alisma* sp.	seed	—	—	—	—
Apiaceae	Apiaceae s.l.	schizocarp	7	5	0.13	9.68
	Apium -type	schizocarp	—	—	—	—
	Bifora radians	schizocarp	1	1	0.02	3.23
	Bupleurum -type	schizocarp	—	—	—	—
	Torilis sp.	schizocarp	—	—	—	—
Asteraceae	Asteraceae s.l.	achene	15	4	0.27	25.81
	Asteraceae s.l.	capitulum	2	1	0.04	6.45
	cf Asteraceae s.l.	achene	—	—	—	—
	Artemisia sp.	achene	3	2	0.05	6.45
	Artemisia sp. - large capitulum	capitulum	—	—	—	—
	Artemisia sp. - small capitulum	capitulum	2761	1591	50.41	25.81
	cf *Artemisia* sp.	achene	2	2	0.04	3.23
	Aster-type	achene	1	1	0.02	3.23
	cf *Aster-type*	achene	—	—	—	—
	Calendula sp.	achene	—	—	—	—
	Carduus nutans-type	achene	—	—	—	—
	Centaurea sp.	achene	9	6	0.16	9.68
	Cichorium sp.	achene	12	11	0.22	6.45
	Crepis- type	achene	—	—	—	—
	Onopordum sp.	achene	2	2	0.04	3.23
	Scorzonera sp.	achene	1	1	0.02	3.23
Boraginaceae	Boraginaceae s.l.	nutlet	1	1	0.02	3.23
	Boraginaceae s.l.	endosperm	—	—	—	—
	Buglossoides tenuiflora	nutlet	—	—	—	—
	Buglossoides arvensis /*Arnebia decumbens*	nutlet	7	2	0.13	19.35
	Echium sp.	nutlet	—	—	—	—
	Heliotropium sp.	nutlet	12	3	0.22	29.03
	Onosma sp.	nutlet	—	—	—	—
	Symphytum- type	nutlet	1	1	0.02	3.23
Brassicaceae	Brassicaceae s.l.	seed	41	5	0.75	48.39
	Brassicaceae s.l.	silique	—	—	—	—
	Alyssum- type	seed	—	—	—	—
	Alyssum /*Lepidium*	seed	—	—	—	—
	Brassica- type	seed	7	5	0.13	6.45
	cf *Brassica* -type	seed	—	—	—	—
	Camelina-type	seed	—	—	—	—
	Cardaria draba	seed	7	2	0.13	16.13
	Conringia-type	seed	—	—	—	—
	Descurania-type	seed	2	1	0.04	6.45
	Euclidum syriacum	silicle	1	1	0.02	3.23
	Lepidium sp.	seed	1	1	0.02	3.23
	Lepidium sp.	silicle	10	9	0.18	6.45
	Lepidium perfoliatum	seed	10	10	0.18	3.23
	Neslia paniculata	silicle	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	seed	2	1	0.04	6.45
	Buffonia sp.	seed	—	—	—	—
	Silene /*Stellaria*	seed	—	—	—	—
	Silene sp.	seed	21	3	0.38	38.71
	cf *Silene* sp.	seed	2	2	0.04	3.23
	Gypsophila sp.	seed	3	1	0.05	9.68
	Vaccaria pyramidata	seed	45	38	0.82	22.58
Chenopodiaceae	Chenopodiaceae s.l.	seed	40	11	0.73	29.03
	Atriplex sp.	bract	12	4	0.22	9.68
	Atriplex sp.	seed	99	51	1.81	35.48
	Beta sp.	seed	—	—	—	—
	Chenopodium murale- type	seed	—	—	—	—
	Chenopodium sp.	seed	102	22	1.86	61.29
	Salsola sp.	seed	38	9	0.69	41.94
	Suaeda sp.	seed	82	11	1.50	67.74
Cistaceae	*Helianthemum* sp.	seed	1	1	0.02	3.23
Convolvulaceae	*Convolvulus* sp.	seed	—	—	—	—
Cupressaceae	*Juniperus* sp.	leaf	—	—	—	—
Cyperaceae	Cyperaceae s.l.	achene	49	6	0.89	58.06
	Cyperaceae s.l.	endosperm	47	9	0.86	67.74
	Bolboschoenus glaucus	achene	42	8	0.77	51.61

			KH-P IV$_{sum}$	KH-P IV$_{max}$	KH-P IV$_{con\text{-}10l}$	KH-P IV$_{ub\%}$
		Samples	31	31	31	31
		Volume (l)	547.7	547.7	547.7	547.7
	Bolboschoenus sp.	achene	3	1	0.05	9.68
	Carex spp. (flattened)	achene	170	46	3.10	74.19
	Carex spp. (trigonous)	achene	—	—	—	—
	Cyperus sp.	achene	—	—	—	—
	Cyperus longus- type	achene	—	—	—	—
	Eleocharis sp.-type 1	achene	18	4	0.33	25.81
	Eleocharis sp.-type 2	achene	1	1	0.02	3.23
	Fimbristylis sp.	achene	—	—	—	—
	Scirpoides holoschoenus	achene	—	—	—	—
–	Cyperaceae/Polygonaceae	achene	9	3	0.16	16.13
	Cyperaceae/Polygonaceae	endosperm	2	1	0.04	6.45
Dipsacaceae	*Dipsacus* /*Cephalaria*	achene	—	—	—	—
	Dipsacus -type	achene	—	—	—	—
	Cephalaria -type	achene	—	—	—	—
	Scabiosa sp.	achene	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	seed	—	—	—	—
	Euphorbia taurinensis -type	seed	1	1	0.02	3.23
Fabaceae	Fabaceae s.l.	seed	7	4	0.13	12.90
	Fabaceae s.l.	pod	—	—	—	—
	Trifolieae s.l.	seed	78	16	1.42	64.52
	Trifolieae s.l.	pod	1	1	0.02	3.23
	Astragalus- type	seed	5	2	0.09	9.68
	Medicago radiata	seed	1	1	0.02	3.23
	Medicago sp.	pod	1	1	0.02	3.23
	Medicago- type	seed	113	15	2.06	74.19
	Melilotus- type	seed	90	17	1.64	61.29
	Trifolium- type	seed	108	40	1.97	77.42
	Trigonella- type	seed	161	28	2.94	77.42
	Coronilla-type	seed	2	1	0.04	6.45
Lamiaceae	Lamiaceae s.l.	nutlet	6	2	0.11	16.13
	Ajuga chamaepitys	nutlet	—	—	—	—
	Ajuga- type	nutlet	6	2	0.11	16.13
	Lallemianta -type	nutlet	1	1	0.02	3.23
	Menta sp.	nutlet	1	1	0.02	3.23
	Nepeta sp.	nutlet	2	1	0.04	6.45
	cf *Nepeta* sp.	nutlet	—	—	—	—
	Stachys- type	nutlet	1	1	0.02	3.23
	Teucrium -type	nutlet	1	1	0.02	3.23
	Ziziphora sp.	nutlet	20	6	0.37	29.03
Liliaceae	Liliaceae s.l.	seed	—	—	—	—
	Allium -type	bulbile	1	1	0.02	3.23
	Bellevalia sp.	seed	3	1	0.05	9.68
	Ornithogalum sp.	seed	5	2	0.09	12.90
Malvaceae	*Malva* sp.	seed	4	2	0.07	9.68
Papaveraceae	*Fumaria* sp.	fruit	4	1	0.07	12.90
	Glaucium sp.	seed	2	1	0.04	6.45
	Papaver sp.	seed	1	1	0.02	3.23
Pinaceae	*Abies* sp.	needle	—	—	—	—
Plantaginaceae	*Plantago* sp.	seed	12	2	0.22	29.03
Poaceae	Poaceae s.l.	caryopsis	139	16	2.54	67.74
	Poaceae s.l.	rachis internode	4	2	0.07	9.68
	Poaceae s.l.	glume	1	1	0.02	3.23
	Poaceae s.l.	awn	—	—	—	—
	Aegilops sp.	caryopsis	1	1	0.02	3.23
	Aegilops sp.	glume base	3	3	0.05	3.23
	Bromus sp.	caryopsis	12	2	0.22	29.03
	Eremopyrum sp.	caryopsis	6	5	0.11	6.45
	Festuca- type	caryopsis	2	1	0.04	6.45
	Hordeum sp. (wild)	caryopsis	10	3	0.18	19.35
	Hordeum sp. (wild)	rachis internode	2	1	0.04	6.45
	Lolium sp.	caryopsis	5	2	0.09	12.90
	Micropyrum -type	caryopsis	1	1	0.02	3.23
	Phalaris sp.	caryopsis	4	2	0.07	9.68
	Poa bulbosa	floret	5	4	0.09	6.45
	Setaria viridis /*verticillata* -type	caryopsis	—	—	—	—
	Stipa sp.	caryopsis	4	2	0.07	9.68
	Taeniatherum caput-medusae	glume base	—	—	—	—



			KH-P IV$_{sum}$	KH-P IV$_{max}$	KH-P IV$_{con-10l}$	KH-P IV$_{ub\%}$
		Samples	31	31	31	31
		Volume (l)	547.7	547.7	547.7	547.7
Polygonaceae	Polygonaceae s.l.	achene	11	2	0.20	22.58
	Polygonaceae s.l.	endosperm	1	1	0.02	3.23
	Persicaria -type	achene	—	—	—	—
	Polygonum sp.	achene	14	3	0.26	29.03
	Polygonum convolvulus	achene	1	1	0.02	3.23
	Polygonum aviculare s.l.	achene	2	1	0.04	6.45
	Rumex sp.	achene	2	1	0.04	6.45
Portulacaceae	*Portulaca oleracea*	seed	5	1	0.09	16.13
Potamogetonaceae	*Potamogeton* sp.	fruit	1	1	0.02	3.23
Primulaceae	*Androsace maxima*	seed	9	2	0.16	16.13
	cf *Androsace* sp.	seed	1	1	0.02	3.23
Ranunculaceae	*Adonis* sp.	achene	7	2	0.13	19.35
	Ceratocephalus falcatus	achene	2	1	0.04	6.45
	Ranunculus sp.	achene	—	—	—	—
Resedaceae	*Reseda lutea* -type	seed	—	—	—	—
Rosaceae	*Sanguisorba* sp.	fruit	—	—	—	—
Rubiaceae	Rubiaceae-type 1	fruit	—	—	—	—
	Galium /Asperula	fruit	—	—	—	—
	Asperula arvensis /orientalis	fruit	1	1	0.02	3.23
	Asperula sp.	fruit	2	1	0.04	6.45
	Galium sp.	fruit	33	8	0.60	41.94
Scrophulariaceae	*Scrophularia /Verbascum*	seed	2	1	0.04	6.45
	Veronica sp.	seed	—	—	—	—
	Veronica dillenii-type	seed	—	—	—	—
	Veronica hederifolia	seed	—	—	—	—
	Veronica polita -type	seed	—	—	—	—
	Veronica triphyllos	seed	—	—	—	—
Solanaceae	Solanaceae s.l.	seed	2	1	0.04	6.45
	Hyoscyamus sp.	seed	61	8	1.11	67.74
	Solanum sp.	seed	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	achene	3	1	0.05	9.68
Valerianaceae	*Valerianella coronata*- type	achene	10	4	0.18	19.35
	Valerianella vesicaria- type	achene	1	1	0.02	3.23
Zygophillaceae	*Peganum harmala*	seed	—	—	—	—

Table 6.20 – *Wild and weedy taxa found in samples from period KH-P IV: sum= absolute count; max= maximum count value in a single sample; con-10l= concentration expressed with a standard value of 10 liters; ub%= ubiquity (percentage of samples in which the taxon is found).*

			KH-P VA_{sum}	KH-P VA_{max}	KH-P $VA_{con-10l}$	KH-P $VA_{ub\%}$
		Samples	10	10	10	10
		Volume (l)	195.6	195.6	195.6	195.6
Wild and weedy plant						
Alismataceae	*Alisma* sp.	seed	—	—	—	—
Apiaceae	Apiaceae s.l.	schizocarp	1	1	0.05	10.00
	Apium -type	schizocarp	—	—	—	—
	Bifora radians	schizocarp	—	—	—	—
	Bupleurum -type	schizocarp	—	—	—	—
	Torilis sp.	schizocarp	—	—	—	—
Asteraceae	Asteraceae s.l.	achene	1	1	0.05	10.00
	Asteraceae s.l.	capitulum	1	1	0.05	10.00
	cf Asteraceae s.l.	achene	—	—	—	—
	Artemisia sp.	achene	2	2	0.10	10.00
	Artemisia sp. - large capitulum	capitulum	—	—	—	—
	Artemisia sp. - small capitulum	capitulum	25	24	1.28	20.00
	cf *Artemisia* sp.	achene	—	—	—	—
	Aster-type	achene	—	—	—	—
	cf *Aster-type*	achene	1	1	0.05	10.00
	Calendula sp.	achene	—	—	—	—
	Carduus nutans-type	achene	—	—	—	—
	Centaurea sp.	achene	—	—	—	—
	Cichorium sp.	achene	—	—	—	—
	Crepis- type	achene	—	—	—	—
	Onopordum sp.	achene	—	—	—	—
	Scorzonera sp.	achene	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	—	—	—	—
	Boraginaceae s.l.	endosperm	—	—	—	—
	Buglossoides tenuiflora	nutlet	—	—	—	—
	Buglossoides arvensis /Arnebia decumbens	nutlet	—	—	—	—
	Echium sp.	nutlet	—	—	—	—
	Heliotropium sp.	nutlet	3	2	0.15	20.00
	Onosma sp.	nutlet	—	—	—	—
	Symphytum- type	nutlet	—	—	—	—
Brassicaceae	Brassicaceae s.l.	seed	6	3	0.31	40.00
	Brassicaceae s.l.	silique	—	—	—	—
	Alyssum- type	seed	—	—	—	—
	Alyssum /Lepidium	seed	—	—	—	—
	Brassica- type	seed	—	—	—	—
	cf *Brassica* -type	seed	—	—	—	—
	Camelina-type	seed	1	1	0.05	10.00
	Cardaria draba	seed	—	—	—	—
	Conringia-type	seed	1	1	0.05	10.00
	Descurania-type	seed	1	1	0.05	10.00
	Euclidum syriacum	silicle	—	—	—	—
	Lepidium sp.	seed	1	1	0.05	10.00
	Lepidium sp.	silicle	—	—	—	—
	Lepidium perfoliatum	seed	12	12	0.61	10.00
	Neslia paniculata	silicle	1	1	0.05	10.00
Caryophyllaceae	Caryophillaceae s.l.	seed	—	—	—	—
	Buffonia sp.	seed	—	—	—	—
	Silene /Stellaria	seed	—	—	—	—
	Silene sp.	seed	2	1	0.10	20.00
	cf *Silene* sp.	seed	1	1	0.05	10.00
	Gypsophila sp.	seed	4	3	0.20	20.00
	Vaccaria pyramidata	seed	4	2	0.20	30.00
Chenopodiaceae	Chenopodiaceae s.l.	seed	20	9	1.02	60.00
	Atriplex sp.	bract	—	—	—	—
	Atriplex sp.	seed	3	3	0.15	10.00
	Beta sp.	seed	—	—	—	—
	Chenopodium murale- type	seed	—	—	—	—
	Chenopodium sp.	seed	63	26	3.22	100.00
	Salsola sp.	seed	21	16	1.07	60.00
	Suaeda sp.	seed	51	19	2.61	100.00
Cistaceae	*Helianthemum* sp.	seed	1	1	0.05	10.00
Convolvulaceae	*Convolvulus* sp.	seed	—	—	—	—
Cupressaceae	*Juniperus* sp.	leaf	—	—	—	—
Cyperaceae	Cyperaceae s.l.	achene	21	5	1.07	80.00
	Cyperaceae s.l.	endosperm	6	2	0.31	40.00
	Bolboschoenus glaucus	achene	9	5	0.46	40.00

			KH-P VA$_{sum}$	KH-P VA$_{max}$	KH-P VA$_{con-10l}$	KH-P VA$_{ub\%}$
		Samples	10	10	10	10
		Volume (l)	195.6	195.6	195.6	195.6
	Bolboschoenus sp.	achene	—	—	—	—
	Carex spp. (flattened)	achene	27	7	1.38	80.00
	Carex spp. (trigonous)	achene	—	—	—	—
	Cyperus sp.	achene	—	—	—	—
	Cyperus longus- type	achene	—	—	—	—
	Eleocharis sp.-type 1	achene	2	2	0.10	10.00
	Eleocharis sp.-type 2	achene	—	—	—	—
	Fimbristylis sp.	achene	—	—	—	—
	Scirpoides holoschoenus	achene	—	—	—	—
–	Cyperaceae/Polygonaceae	achene	10	5	0.51	40.00
	Cyperaceae/Polygonaceae	endosperm	1	1	0.05	10.00
Dipsacaceae	*Dipsacus* /*Cephalaria*	achene	—	—	—	—
	Dipsacus -type	achene	—	—	—	—
	Cephalaria -type	achene	—	—	—	—
	Scabiosa sp.	achene	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	seed	—	—	—	—
	Euphorbia taurinensis -type	seed	—	—	—	—
Fabaceae	Fabaceae s.l.	seed	1	1	0.05	10.00
	Fabaceae s.l.	pod	2	2	0.10	10.00
	Trifolieae s.l.	seed	36	8	1.84	70.00
	Trifolieae s.l.	pod	—	—	—	—
	Astragalus- type	seed	1	1	0.05	10.00
	Medicago radiata	seed	—	—	—	—
	Medicago sp.	pod	—	—	—	—
	Medicago- type	seed	25	8	1.28	70.00
	Melilotus- type	seed	18	9	0.92	40.00
	Trifolium- type	seed	20	8	1.02	70.00
	Trigonella- type	seed	71	31	3.63	80.00
	Coronilla-type	seed	—	—	—	—
Lamiaceae	Lamiaceae s.l.	nutlet	10	5	0.51	30.00
	Ajuga chamaepitys	nutlet	—	—	—	—
	Ajuga- type	nutlet	—	—	—	—
	Lallemianta -type	nutlet	—	—	—	—
	Menta sp.	nutlet	—	—	—	—
	Nepeta sp.	nutlet	—	—	—	—
	cf *Nepeta* sp.	nutlet	—	—	—	—
	Stachys- type	nutlet	—	—	—	—
	Teucrium -type	nutlet	6	3	0.31	30.00
	Ziziphora sp.	nutlet	7	3	0.36	30.00
Liliaceae	Liliaceae s.l.	seed	—	—	—	—
	Allium -type	bulbile	—	—	—	—
	Bellevalia sp.	seed	1	1	0.05	10.00
	Ornithogalum sp.	seed	—	—	—	—
Malvaceae	*Malva* sp.	seed	1	1	0.05	10.00
Papaveraceae	*Fumaria* sp.	fruit	—	—	—	—
	Glaucium sp.	seed	—	—	—	—
	Papaver sp.	seed	1	1	0.05	10.00
Pinaceae	*Abies* sp.	needle	—	—	—	—
Plantaginaceae	*Plantago* sp.	seed	—	—	—	—
Poaceae	Poaceae s.l.	caryopsis	64	11	3.27	100.00
	Poaceae s.l.	rachis internode	4	3	0.20	20.00
	Poaceae s.l.	glume	—	—	—	—
	Poaceae s.l.	awn	—	—	—	—
	Aegilops sp.	caryopsis	—	—	—	—
	Aegilops sp.	glume base	—	—	—	—
	Bromus sp.	caryopsis	5	5	0.26	10.00
	Eremopyrum sp.	caryopsis	—	—	—	—
	Festuca- type	caryopsis	—	—	—	—
	Hordeum sp. (wild)	caryopsis	—	—	—	—
	Hordeum sp. (wild)	rachis internode	—	—	—	—
	Lolium sp.	caryopsis	6	2	0.31	50.00
	Micropyrum -type	caryopsis	—	—	—	—
	Phalaris sp.	caryopsis	—	—	—	—
	Poa bulbosa	floret	—	—	—	—
	Setaria viridis /*verticillata* -type	caryopsis	—	—	—	—
	Stipa sp.	caryopsis	3	2	0.15	20.00
	Taeniatherum caput-medusae	glume base	—	—	—	—

			KH-P VA$_{sum}$	KH-P VA$_{max}$	KH-P VA$_{con\text{-}10l}$	KH-P VA$_{ub\%}$
		Samples	10	10	10	10
		Volume (l)	195.6	195.6	195.6	195.6
Polygonaceae	Polygonaceae s.l.	achene	14	12	0.72	30.00
	Polygonaceae s.l.	endosperm	—	—	—	—
	Persicaria -type	achene	—	—	—	—
	Polygonum sp.	achene	5	5	0.26	10.00
	Polygonum convolvulus	achene	—	—	—	—
	Polygonum aviculare s.l.	achene	—	—	—	—
	Rumex sp.	achene	—	—	—	—
Portulacaceae	*Portulaca oleracea*	seed	1	1	0.05	10.00
Potamogetonaceae	*Potamogeton* sp.	fruit	—	—	—	—
Primulaceae	*Androsace maxima*	seed	1	1	0.05	10.00
	cf *Androsace* sp.	seed	—	—	—	—
Ranunculaceae	*Adonis* sp.	achene	1	1	0.05	10.00
	Ceratocephalus falcatus	achene	—	—	—	—
	Ranunculus sp.	achene	—	—	—	—
Resedaceae	*Reseda lutea* -type	seed	—	—	—	—
Rosaceae	*Sanguisorba* sp.	fruit	—	—	—	—
Rubiaceae	Rubiaceae-type 1	fruit	—	—	—	—
	Galium /*Asperula*	fruit	—	—	—	—
	Asperula arvensis /*orientalis*	fruit	2	1	0.10	20.00
	Asperula sp.	fruit	—	—	—	—
	Galium sp.	fruit	17	10	0.87	60.00
Scrophulariaceae	*Scrophularia* /*Verbascum*	seed	—	—	—	—
	Veronica sp.	seed	—	—	—	—
	Veronica dillenii-type	seed	—	—	—	—
	Veronica hederifolia	seed	—	—	—	—
	Veronica polita -type	seed	—	—	—	—
	Veronica triphyllos	seed	—	—	—	—
Solanaceae	Solanaceae s.l.	seed	—	—	—	—
	Hyoscyamus sp.	seed	18	4	0.92	80.00
	Solanum sp.	seed	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	achene	2	1	0.10	20.00
Valerianaceae	*Valerianella coronata*- type	achene	3	2	0.15	20.00
	Valerianella vesicaria- type	achene	—	—	—	—
Zygophillaceae	*Peganum harmala*	seed	—	—	—	—

Table 6.21 – *Wild and weedy taxa found in samples from period KH-P VA: sum= absolute count; max= maximum count value in a single sample; con-10l= concentration expressed with a standard value of 10 liters; ub%= ubiquity (percentage of samples in which the taxon is found).*

			KH-P VB$_{sum}$	KH-P VB$_{max}$	KH-P VB$_{con-10l}$	KH-P VB$_{ub\%}$
		Samples	9	9	9	9
		Volume (l)	203	203	203	203
Wild and weedy plant						
Alismataceae	*Alisma* sp.	seed	—	—	—	—
Apiaceae	Apiaceae s.l.	schizocarp	—	—	—	—
	Apium -type	schizocarp	—	—	—	—
	Bifora radians	schizocarp	—	—	—	—
	Bupleurum -type	schizocarp	—	—	—	—
	Torilis sp.	schizocarp	—	—	—	—
Asteraceae	Asteraceae s.l.	achene	—	—	—	—
	Asteraceae s.l.	capitulum	—	—	—	—
	cf Asteraceae s.l.	achene	—	—	—	—
	Artemisia sp.	achene	—	—	—	—
	Artemisia sp. - large capitulum	capitulum	—	—	—	—
	Artemisia sp. - small capitulum	capitulum	—	—	—	—
	cf *Artemisia* sp.	achene	—	—	—	—
	Aster-type	achene	—	—	—	—
	cf *Aster-type*	achene	—	—	—	—
	Calendula sp.	achene	—	—	—	—
	Carduus nutans-type	achene	—	—	—	—
	Centaurea sp.	achene	—	—	—	—
	Cichorium sp.	achene	—	—	—	—
	Crepis- type	achene	—	—	—	—
	Onopordum sp.	achene	—	—	—	—
	Scorzonera sp.	achene	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	—	—	—	—
	Boraginaceae s.l.	endosperm	—	—	—	—
	Buglossoides tenuiflora	nutlet	—	—	—	—
	Buglossoides arvensis /Arnebia decumbens	nutlet	4	2	0.20	33.33
	Echium sp.	nutlet	—	—	—	—
	Heliotropium sp.	nutlet	2	1	0.10	22.22
	Onosma sp.	nutlet	—	—	—	—
	Symphytum- type	nutlet	—	—	—	—
Brassicaceae	Brassicaceae s.l.	seed	13	7	0.64	55.56
	Brassicaceae s.l.	silique	—	—	—	—
	Alyssum- type	seed	—	—	—	—
	Alyssum /Lepidium	seed	—	—	—	—
	Brassica- type	seed	—	—	—	—
	cf *Brassica* -type	seed	—	—	—	—
	Camelina-type	seed	—	—	—	—
	Cardaria draba	seed	—	—	—	—
	Conringia-type	seed	—	—	—	—
	Descurania-type	seed	3	2	0.15	22.22
	Euclidum syriacum	silicle	—	—	—	—
	Lepidium sp.	seed	—	—	—	—
	Lepidium sp.	silicle	—	—	—	—
	Lepidium perfoliatum	seed	—	—	—	—
	Neslia paniculata	silicle	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	seed	—	—	—	—
	Buffonia sp.	seed	—	—	—	—
	Silene /Stellaria	seed	—	—	—	—
	Silene sp.	seed	7	3	0.34	55.56
	cf *Silene* sp.	seed	—	—	—	—
	Gypsophila sp.	seed	1	1	0.05	11.11
	Vaccaria pyramidata	seed	4	2	0.20	33.33
Chenopodiaceae	Chenopodiaceae s.l.	seed	11	5	0.54	55.56
	Atriplex sp.	bract	—	—	—	—
	Atriplex sp.	seed	12	5	0.59	44.44
	Beta sp.	seed	—	—	—	—
	Chenopodium murale- type	seed	1	1	0.05	11.11
	Chenopodium sp.	seed	27	10	1.33	66.67
	Salsola sp.	seed	2	1	0.10	22.22
	Suaeda sp.	seed	40	14	1.97	88.89
Cistaceae	*Helianthemum* sp.	seed	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	seed	—	—	—	—
Cupressaceae	*Juniperus* sp.	leaf	—	—	—	—
Cyperaceae	Cyperaceae s.l.	achene	29	10	1.43	77.78
	Cyperaceae s.l.	endosperm	8	2	0.39	55.56
	Bolboschoenus glaucus	achene	14	4	0.69	66.67

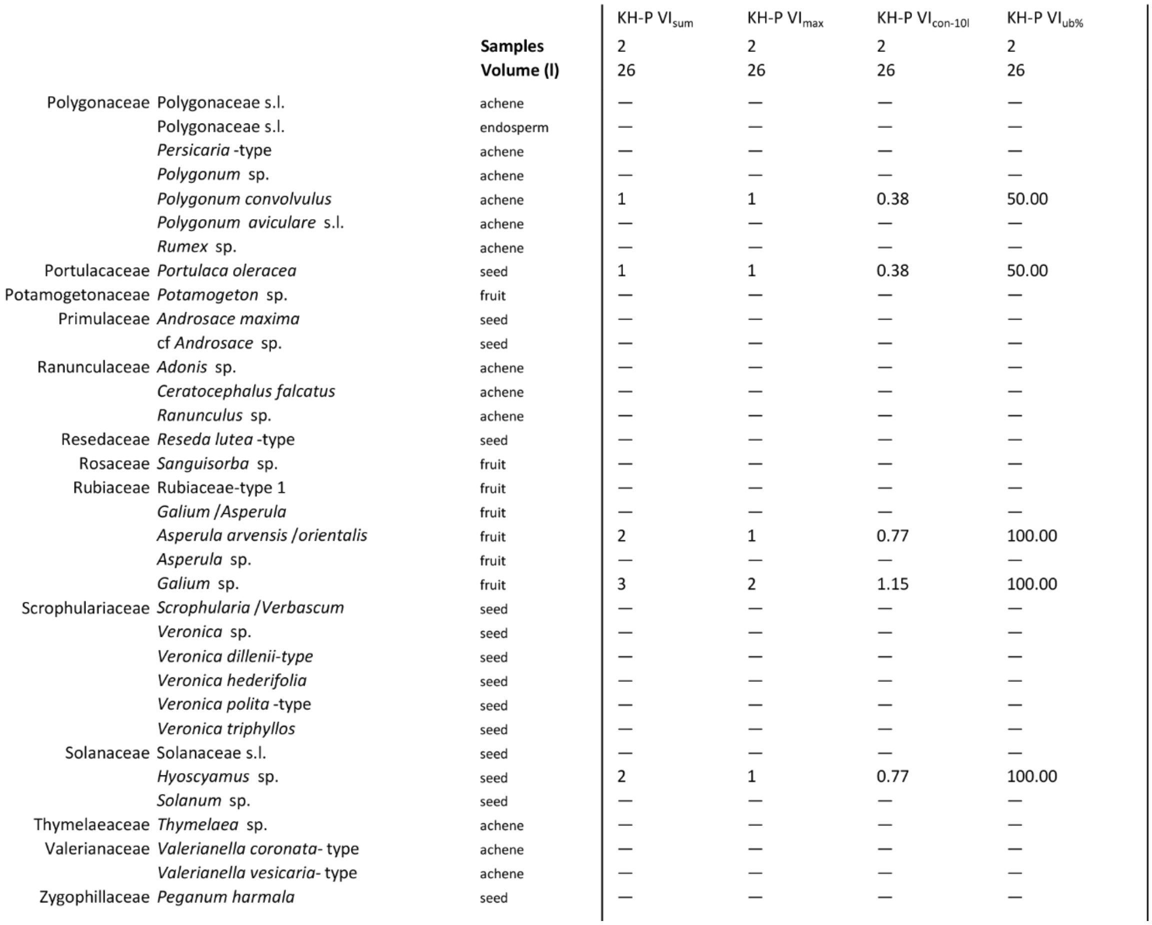
			KH-P VB$_{sum}$	KH-P VB$_{max}$	KH-P VB$_{con\text{-}10l}$	KH-P VB$_{ub\%}$
		Samples	9	9	9	9
		Volume (l)	203	203	203	203
	Bolboschoenus sp.	achene	—	—	—	—
	Carex spp. (flattened)	achene	46	13	2.27	100.00
	Carex spp. (trigonous)	achene	—	—	—	—
	Cyperus sp.	achene	—	—	—	—
	Cyperus longus- type	achene	—	—	—	—
	Eleocharis sp.-type 1	achene	—	—	—	—
	Eleocharis sp.-type 2	achene	—	—	—	—
	Fimbristylis sp.	achene	—	—	—	—
	Scirpoides holoschoenus	achene	—	—	—	—
–	Cyperaceae/Polygonaceae	achene	3	3	0.15	11.11
	Cyperaceae/Polygonaceae	endosperm	—	—	—	—
Dipsacaceae	*Dipsacus* /*Cephalaria*	achene	—	—	—	—
	Dipsacus -type	achene	—	—	—	—
	Cephalaria -type	achene	—	—	—	—
	Scabiosa sp.	achene	1	1	0.05	11.11
Euphorbiaceae	*Euphorbia falcata*- type	seed	—	—	—	—
	Euphorbia taurinensis -type	seed	—	—	—	—
Fabaceae	Fabaceae s.l.	seed	—	—	—	—
	Fabaceae s.l.	pod	—	—	—	—
	Trifolieae s.l.	seed	8	4	0.39	33.33
	Trifolieae s.l.	pod	—	—	—	—
	Astragalus- type	seed	4	2	0.20	22.22
	Medicago radiata	seed	—	—	—	—
	Medicago sp.	pod	—	—	—	—
	Medicago- type	seed	33	9	1.63	66.67
	Melilotus- type	seed	10	3	0.49	55.56
	Trifolium- type	seed	72	21	3.55	100.00
	Trigonella- type	seed	31	9	1.53	88.89
	Coronilla-type	seed	1	1	0.05	11.11
Lamiaceae	Lamiaceae s.l.	nutlet	1	1	0.05	11.11
	Ajuga chamaepitys	nutlet	—	—	—	—
	Ajuga- type	nutlet	4	2	0.20	33.33
	Lallemianta -type	nutlet	—	—	—	—
	Menta sp.	nutlet	—	—	—	—
	Nepeta sp.	nutlet	—	—	—	—
	cf *Nepeta* sp.	nutlet	—	—	—	—
	Stachys- type	nutlet	—	—	—	—
	Teucrium -type	nutlet	—	—	—	—
	Ziziphora sp.	nutlet	7	4	0.34	33.33
Liliaceae	Liliaceae s.l.	seed	—	—	—	—
	Allium -type	bulbile	—	—	—	—
	Bellevalia sp.	seed	—	—	—	—
	Ornithogalum sp.	seed	—	—	—	—
Malvaceae	*Malva* sp.	seed	1	1	0.05	11.11
Papaveraceae	*Fumaria* sp.	fruit	—	—	—	—
	Glaucium sp.	seed	—	—	—	—
	Papaver sp.	seed	1	1	0.05	11.11
Pinaceae	*Abies* sp.	needle	—	—	—	—
Plantaginaceae	*Plantago* sp.	seed	2	1	0.10	22.22
Poaceae	Poaceae s.l.	caryopsis	110	39	5.42	77.78
	Poaceae s.l.	rachis internode	—	—	—	—
	Poaceae s.l.	glume	—	—	—	—
	Poaceae s.l.	awn	—	—	—	—
	Aegilops sp.	caryopsis	—	—	—	—
	Aegilops sp.	glume base	—	—	—	—
	Bromus sp.	caryopsis	2	1	0.10	22.22
	Eremopyrum sp.	caryopsis	—	—	—	—
	Festuca- type	caryopsis	—	—	—	—
	Hordeum sp. (wild)	caryopsis	3	1	0.15	33.33
	Hordeum sp. (wild)	rachis internode	—	—	—	—
	Lolium sp.	caryopsis	1	1	0.05	11.11
	Micropyrum -type	caryopsis	—	—	—	—
	Phalaris sp.	caryopsis	—	—	—	—
	Poa bulbosa	floret	—	—	—	—
	Setaria viridis /*verticillata* -type	caryopsis	—	—	—	—
	Stipa sp.	caryopsis	2	1	0.10	22.22
	Taeniatherum caput-medusae	glume base	—	—	—	—

			KH-P VB$_{sum}$	KH-P VB$_{max}$	KH-P VB$_{con\text{-}10l}$	KH-P VB$_{ub\%}$
		Samples	9	9	9	9
		Volume (l)	203	203	203	203
Polygonaceae	Polygonaceae s.l.	achene	—	—	—	—
	Polygonaceae s.l.	endosperm	—	—	—	—
	Persicaria -type	achene	1	1	0.05	11.11
	Polygonum sp.	achene	2	2	0.10	11.11
	Polygonum convolvulus	achene	—	—	—	—
	Polygonum aviculare s.l.	achene	2	1	0.10	22.22
	Rumex sp.	achene	4	2	0.20	33.33
Portulacaceae	*Portulaca oleracea*	seed	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	fruit	—	—	—	—
Primulaceae	*Androsace maxima*	seed	—	—	—	—
	cf *Androsace* sp.	seed	—	—	—	—
Ranunculaceae	*Adonis* sp.	achene	1	1	0.05	11.11
	Ceratocephalus falcatus	achene	—	—	—	—
	Ranunculus sp.	achene	—	—	—	—
Resedaceae	*Reseda lutea* -type	seed	—	—	—	—
Rosaceae	*Sanguisorba* sp.	fruit	—	—	—	—
Rubiaceae	Rubiaceae-type 1	fruit	—	—	—	—
	Galium /Asperula	fruit	—	—	—	—
	Asperula arvensis /orientalis	fruit	4	2	0.20	33.33
	Asperula sp.	fruit	2	1	0.10	22.22
	Galium sp.	fruit	5	2	0.25	33.33
Scrophulariaceae	*Scrophularia /Verbascum*	seed	1	1	0.05	11.11
	Veronica sp.	seed	—	—	—	—
	Veronica dillenii-type	seed	—	—	—	—
	Veronica hederifolia	seed	—	—	—	—
	Veronica polita -type	seed	—	—	—	—
	Veronica triphyllos	seed	—	—	—	—
Solanaceae	Solanaceae s.l.	seed	—	—	—	—
	Hyoscyamus sp.	seed	22	5	1.08	88.89
	Solanum sp.	seed	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	achene	2	1	0.10	22.22
Valerianaceae	*Valerianella coronata*- type	achene	—	—	—	—
	Valerianella vesicaria- type	achene	—	—	—	—
Zygophillaceae	*Peganum harmala*	seed	—	—	—	—

Table 6.22 – *Wild and weedy taxa found in samples from period KH-P VB: sum= absolute count; max= maximum count value in a single sample; con-10l= concentration expressed with a standard value of 10 liters; ub%= ubiquity (percentage of samples in which the taxon is found).*

			KH-P VI$_{sum}$	KH-P VI$_{max}$	KH-P VI$_{con-10l}$	KH-P VI$_{ub\%}$
		Samples	2	2	2	2
		Volume (l)	26	26	26	26
Wild and weedy plant						
Alismataceae	*Alisma* sp.	seed	—	—	—	—
Apiaceae	Apiaceae s.l.	schizocarp	—	—	—	—
	Apium -type	schizocarp	—	—	—	—
	Bifora radians	schizocarp	—	—	—	—
	Bupleurum -type	schizocarp	—	—	—	—
	Torilis sp.	schizocarp	—	—	—	—
Asteraceae	Asteraceae s.l.	achene	—	—	—	—
	Asteraceae s.l.	capitulum	—	—	—	—
	cf Asteraceae s.l.	achene	—	—	—	—
	Artemisia sp.	achene	—	—	—	—
	Artemisia sp. - large capitulum	capitulum	—	—	—	—
	Artemisia sp. - small capitulum	capitulum	—	—	—	—
	cf *Artemisia* sp.	achene	—	—	—	—
	Aster-type	achene	—	—	—	—
	cf *Aster-type*	achene	—	—	—	—
	Calendula sp.	achene	—	—	—	—
	Carduus nutans-type	achene	—	—	—	—
	Centaurea sp.	achene	—	—	—	—
	Cichorium sp.	achene	—	—	—	—
	Crepis- type	achene	—	—	—	—
	Onopordum sp.	achene	—	—	—	—
	Scorzonera sp.	achene	—	—	—	—
Boraginaceae	Boraginaceae s.l.	nutlet	—	—	—	—
	Boraginaceae s.l.	endosperm	—	—	—	—
	Buglossoides tenuiflora	nutlet	—	—	—	—
	Buglossoides arvensis /Arnebia decumbens	nutlet	1	1	0.38	50.00
	Echium sp.	nutlet	—	—	—	—
	Heliotropium sp.	nutlet	—	—	—	—
	Onosma sp.	nutlet	—	—	—	—
	Symphytum- type	nutlet	—	—	—	—
Brassicaceae	Brassicaceae s.l.	seed	—	—	—	—
	Brassicaceae s.l.	silique	—	—	—	—
	Alyssum- type	seed	—	—	—	—
	Alyssum /Lepidium	seed	—	—	—	—
	Brassica- type	seed	—	—	—	—
	cf *Brassica* -type	seed	—	—	—	—
	Camelina-type	seed	—	—	—	—
	Cardaria draba	seed	—	—	—	—
	Conringia-type	seed	—	—	—	—
	Descurania-type	seed	—	—	—	—
	Euclidum syriacum	silicle	—	—	—	—
	Lepidium sp.	seed	—	—	—	—
	Lepidium sp.	silicle	—	—	—	—
	Lepidium perfoliatum	seed	—	—	—	—
	Neslia paniculata	silicle	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	seed	—	—	—	—
	Buffonia sp.	seed	—	—	—	—
	Silene /Stellaria	seed	—	—	—	—
	Silene sp.	seed	—	—	—	—
	cf *Silene* sp.	seed	—	—	—	—
	Gypsophila sp.	seed	—	—	—	—
	Vaccaria pyramidata	seed	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	seed	4	3	1.54	100.00
	Atriplex sp.	bract	—	—	—	—
	Atriplex sp.	seed	—	—	—	—
	Beta sp.	seed	—	—	—	—
	Chenopodium murale- type	seed	—	—	—	—
	Chenopodium sp.	seed	7	6	2.69	100.00
	Salsola sp.	seed	1	1	0.38	50.00
	Suaeda sp.	seed	17	11	6.54	100.00
Cistaceae	*Helianthemum* sp.	seed	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	seed	—	—	—	—
Cupressaceae	*Juniperus* sp.	leaf	—	—	—	—
Cyperaceae	Cyperaceae s.l.	achene	2	2	0.77	50.00
	Cyperaceae s.l.	endosperm	—	—	—	—
	Bolboschoenus glaucus	achene	4	3	1.54	100.00

			KH-P VI_{sum}	KH-P VI_{max}	KH-P $\text{VI}_{\text{con-10l}}$	KH-P $\text{VI}_{\text{ub\%}}$
		Samples	2	2	2	2
		Volume (l)	26	26	26	26
	Bolboschoenus sp.	achene	—	—	—	—
	Carex spp. (flattened)	achene	—	—	—	—
	Carex spp. (trigonous)	achene	—	—	—	—
	Cyperus sp.	achene	—	—	—	—
	Cyperus longus- type	achene	—	—	—	—
	Eleocharis sp.-type 1	achene	—	—	—	—
	Eleocharis sp.-type 2	achene	—	—	—	—
	Fimbristylis sp.	achene	—	—	—	—
	Scirpoides holoschoenus	achene	—	—	—	—
–	Cyperaceae/Polygonaceae	achene	1	1	0.38	50.00
	Cyperaceae/Polygonaceae	endosperm	—	—	—	—
Dipsacaceae	*Dipsacus* /*Cephalaria*	achene	—	—	—	—
	Dipsacus -type	achene	—	—	—	—
	Cephalaria -type	achene	—	—	—	—
	Scabiosa sp.	achene	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	seed	—	—	—	—
	Euphorbia taurinensis -type	seed	—	—	—	—
Fabaceae	Fabaceae s.l.	seed	2	2	0.77	50.00
	Fabaceae s.l.	pod	—	—	—	—
	Trifolieae s.l.	seed	2	2	0.77	50.00
	Trifolieae s.l.	pod	—	—	—	—
	Astragalus- type	seed	1	1	0.38	50.00
	Medicago radiata	seed	—	—	—	—
	Medicago sp.	pod	—	—	—	—
	Medicago- type	seed	2	2	0.77	50.00
	Melilotus- type	seed	3	3	1.15	50.00
	Trifolium- type	seed	1	1	0.38	50.00
	Trigonella- type	seed	2	2	0.77	50.00
	Coronilla-type	seed	—	—	—	—
Lamiaceae	Lamiaceae s.l.	nutlet	—	—	—	—
	Ajuga chamaepitys	nutlet	—	—	—	—
	Ajuga- type	nutlet	—	—	—	—
	Lallemianta -type	nutlet	—	—	—	—
	Menta sp.	nutlet	—	—	—	—
	Nepeta sp.	nutlet	—	—	—	—
	cf *Nepeta* sp.	nutlet	—	—	—	—
	Stachys- type	nutlet	—	—	—	—
	Teucrium -type	nutlet	—	—	—	—
	Ziziphora sp.	nutlet	—	—	—	—
Liliaceae	Liliaceae s.l.	seed	—	—	—	—
	Allium -type	bulbile	—	—	—	—
	Bellevalia sp.	seed	—	—	—	—
	Ornithogalum sp.	seed	—	—	—	—
Malvaceae	*Malva* sp.	seed	—	—	—	—
Papaveraceae	*Fumaria* sp.	fruit	—	—	—	—
	Glaucium sp.	seed	—	—	—	—
	Papaver sp.	seed	—	—	—	—
Pinaceae	*Abies* sp.	needle	—	—	—	—
Plantaginaceae	*Plantago* sp.	seed	—	—	—	—
Poaceae	Poaceae s.l.	caryopsis	10	7	3.85	100.00
	Poaceae s.l.	rachis internode	1	1	0.38	50.00
	Poaceae s.l.	glume	—	—	—	—
	Poaceae s.l.	awn	—	—	—	—
	Aegilops sp.	caryopsis	—	—	—	—
	Aegilops sp.	glume base	—	—	—	—
	Bromus sp.	caryopsis	—	—	—	—
	Eremopyrum sp.	caryopsis	—	—	—	—
	Festuca- type	caryopsis	—	—	—	—
	Hordeum sp. (wild)	caryopsis	—	—	—	—
	Hordeum sp. (wild)	rachis internode	—	—	—	—
	Lolium sp.	caryopsis	—	—	—	—
	Micropyrum -type	caryopsis	—	—	—	—
	Phalaris sp.	caryopsis	—	—	—	—
	Poa bulbosa	floret	—	—	—	—
	Setaria viridis /*verticillata* -type	caryopsis	—	—	—	—
	Stipa sp.	caryopsis	1	1	0.38	50.00
	Taeniatherum caput-medusae	glume base	—	—	—	—



			KH-P VI_{sum}	KH-P VI_{max}	KH-P $VI_{con-10l}$	KH-P $VI_{ub\%}$
		Samples	2	2	2	2
		Volume (l)	26	26	26	26
Polygonaceae	Polygonaceae s.l.	achene	—	—	—	—
	Polygonaceae s.l.	endosperm	—	—	—	—
	Persicaria -type	achene	—	—	—	—
	Polygonum sp.	achene	—	—	—	—
	Polygonum convolvulus	achene	1	1	0.38	50.00
	Polygonum aviculare s.l.	achene	—	—	—	—
	Rumex sp.	achene	—	—	—	—
Portulacaceae	*Portulaca oleracea*	seed	1	1	0.38	50.00
Potamogetonaceae	*Potamogeton* sp.	fruit	—	—	—	—
Primulaceae	*Androsace maxima*	seed	—	—	—	—
	cf *Androsace* sp.	seed	—	—	—	—
Ranunculaceae	*Adonis* sp.	achene	—	—	—	—
	Ceratocephalus falcatus	achene	—	—	—	—
	Ranunculus sp.	achene	—	—	—	—
Resedaceae	*Reseda lutea* -type	seed	—	—	—	—
Rosaceae	*Sanguisorba* sp.	fruit	—	—	—	—
Rubiaceae	Rubiaceae-type 1	fruit	—	—	—	—
	Galium /Asperula	fruit	—	—	—	—
	Asperula arvensis /orientalis	fruit	2	1	0.77	100.00
	Asperula sp.	fruit	—	—	—	—
	Galium sp.	fruit	3	2	1.15	100.00
Scrophulariaceae	*Scrophularia /Verbascum*	seed	—	—	—	—
	Veronica sp.	seed	—	—	—	—
	Veronica dillenii-type	seed	—	—	—	—
	Veronica hederifolia	seed	—	—	—	—
	Veronica polita -type	seed	—	—	—	—
	Veronica triphyllos	seed	—	—	—	—
Solanaceae	Solanaceae s.l.	seed	—	—	—	—
	Hyoscyamus sp.	seed	2	1	0.77	100.00
	Solanum sp.	seed	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	achene	—	—	—	—
Valerianaceae	*Valerianella coronata-* type	achene	—	—	—	—
	Valerianella vesicaria- type	achene	—	—	—	—
Zygophillaceae	*Peganum harmala*	seed	—	—	—	—

Table 6.23 – *Wild and weedy taxa found in samples from period KH-P VI: sum= absolute count; max= maximum count value in a single sample; con-10l= concentration expressed with a standard value of 10 liters; ub%= ubiquity (percentage of samples in which the taxon is found).*

6.3.5 *Unknown types and indeterminable specimens*

As expected, considering the floristic richness of the assemblage, some specimens could not be identified. In the instances in which potentially diagnostic anatomic features are visible, these specimens are listed as “unknowns”. Poorly preserved items, without clearly observable diagnostic anatomy, are regarded as “indeterminable”. An identification code (KH-$unk_{(nr)}$) is given to the unknown types that occur in more than one sample. For these latter types, photographic documentation and counts are provided in Appendix 7. In this section I will discuss exclusively KH-unk 1 (Figure 6. 27).

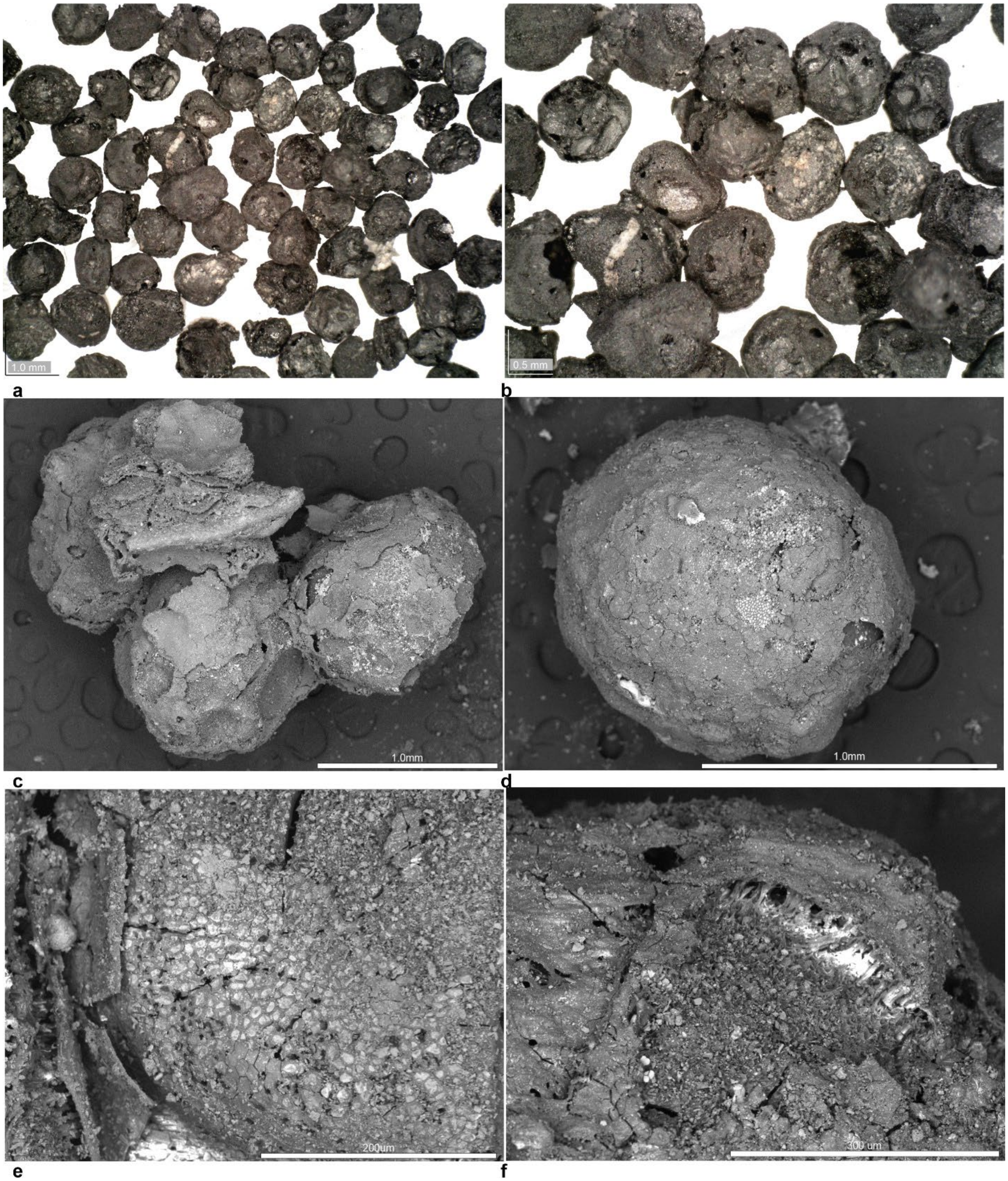

1.0 mm
a
0.5 mm
b
1.0mm
c
1.0mm
d
200um
e
300 um
f

Figure 6.27 – U*nknown taxon KH-unk1:* (*a*), *KIN17A1893s149;* (*b*), *KIN17A1893s149;* (*c-f*), *SEM pictures of specimens from sample KIN15D2379s117*

KH-unk1 is taxon attested with an important ubiquity during period KH-P III (500-200 BCE), KH-P IIB (200-1 BCE), and KH-P I (1200-1450 CE) – thus occurring in concomitance to a drastic increase in wild/weed seed concentrations (Figure 6.22). Specimens attributable to this type are not attested in the earlier occupation periods (KH-P VI to IV, 1600-500 BCE) considered in the study. When present, KH-unk1 is often found in large concentrations (Appendix 7), both in form of loose specimens (Figure 6.27, a, b, d) and aggregate items (Figure 6.27, c). The shape of the type is globose/sub-globose, with a diameter of ca. 1.5 - 0.5 mm. The surface is somehow wrinkled, with irregular depressions (Figure 6.27, c). An external layer (coat? rind?) is present, although always poorly preserved, under which it is possible to notice a polygonal cell structure (Figure 6.27, e). Although these specimens are likely to be attribute to a single taxon, a minor degree of mixing with poorly preserved small round seeds having a degraded seed coat is to be expected.

KH-unk1 remains to date unidentified. Several possibilities were considered and are still under considerations. Based on size, overall shape, and numerousness, an identification as millet grains was initially considered. The possibility was, however, disregarded according to the observable morphology – most notably the lack of visible scutellum and the spherical shape – to which it is added the rather odd absence of 'typical' millet grains in samples containing large concentrations of this unknown (Appendix 7). Various candidates in the wild and weed flora were considered, without reaching a positive identification. It was finally explored the possibility of these specimens being fungi sclerotia (see Section 6.3.6) (Smith et al. 2015), rather than plant-based remains. This latter hypothesis is still under consideration, noting among the possible candidate mold-like fungus taxa, such as members of the *Aspergillus/Penicillium* group or *Athelia* (*Sclerotium*) *rolfsii*.[33] Pending the availability of modern charred sclerotia, this possibility cannot be further evaluated. It is currently in program a charring experiment aimed to provide the adequate reference materials to either confirm or disregard this hypothesis. Further work is needed in order to clarify this standing issue.

6.3.6 *other plant parts, dung pellets, insects*

In addition to seed and fruit remains, other non-wood plant parts are documented in the flotation samples. These items are reported in Appendix 7 and described in Appendix 6. Among non-carpological plant parts, I should mention the presence of fir needles (*Abies* sp.; samples KIN15B2113s108 and KIN15A1539s77) and juniper leaves (*Juniperus excelsa* type; samples KIN16A1685s52, KIN16A1732s70, KIN17A1894s158, KIN13A175s117). The presence of fir needles has been already discussed (Section 5.4.2) as possible indication of a former presence of relics populations of Cilician fir (*Abies cilicica*) in the wettest slopes of the Cappadocian mountains. It is regarded as likely that these needles were incorporated into the archaeological deposit via ruminant dung burning, considering the lack of *Abies* wood charcoal in the same flotation samples (Appendix 5). Dung has been identified and quantified only in the instances in which clearly recognized pellets were present (Charles 1998), which point to a sheep/goat origin (Figure 6.29, a). Identifiable sheep/goat dung pellets were found in a total of 9 samples, which are attributed to KH-P III (500-200 BCE), IIB (200-1 BCE), and I (1200-1450 CE) (Appendix 6 and 7). In other instances, the presence of charred vegetal clots, possibly originating from processed dung cakes, has been more conservatively quantified as 'amorphous material'.

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[33] I thank Dr. Donald Pfister (Harvard University) for suggesting this this possible, tentative, identification.

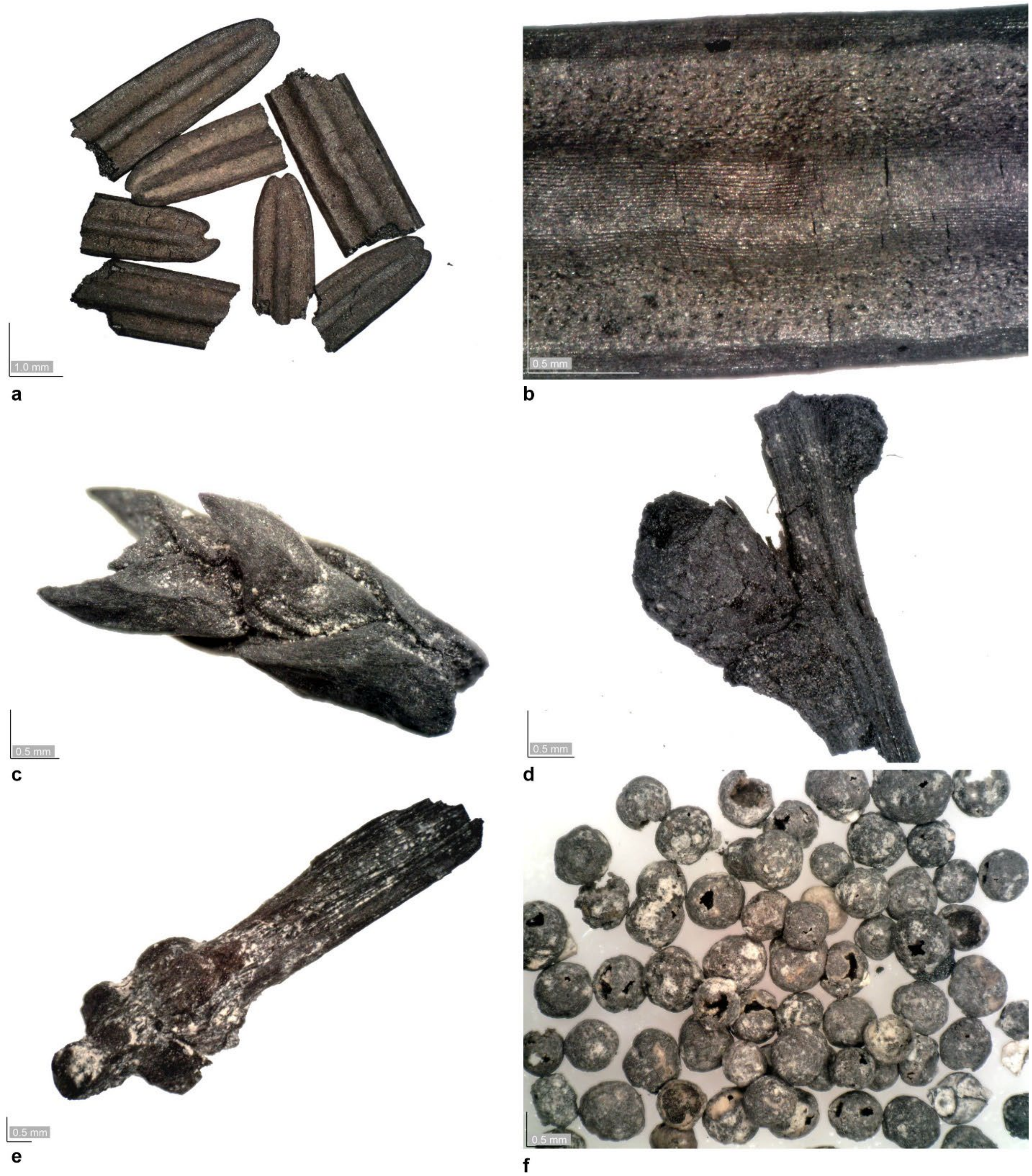

1.0 mm
a
0.5 mm
b
0.5 mm
c
0.5 mm
d
0.5 mm
e
0.5 mm
f

Figure 6.28 – *Miscellanea of plant parts: (a) and (b),* Abies *sp. needle (KIN15A1539s77); (c),* Juniperus excelsa-*Type leaf (KIN16A1685s52); (d), bud attached to a 1-year-old twig (KIN17A1894s157); (e), monocot root (KIN17A878s165); (f), sclerotia (KIN16A1711s67).*

Among non-plant materials present in the flotation samples, it should be noted the sporadic presence of charred insect remains (Appendix 6 and 7). Among these specimens it is documented the presence of wheat weevil (*Sitophilus granarius*), a primary storage pest (Plarre 2010). Adults of wheat weevil were found in 2 samples (KIN14B2032s135a and KIN12B522s96), originating from Operation B and dated respectively to period KH-P IIB (200-1 BCE) and KH-P I (1200-1450 CE). Panagiotakopulu and Buckland (2016) provide a review of the archaeological attestations of this pest.

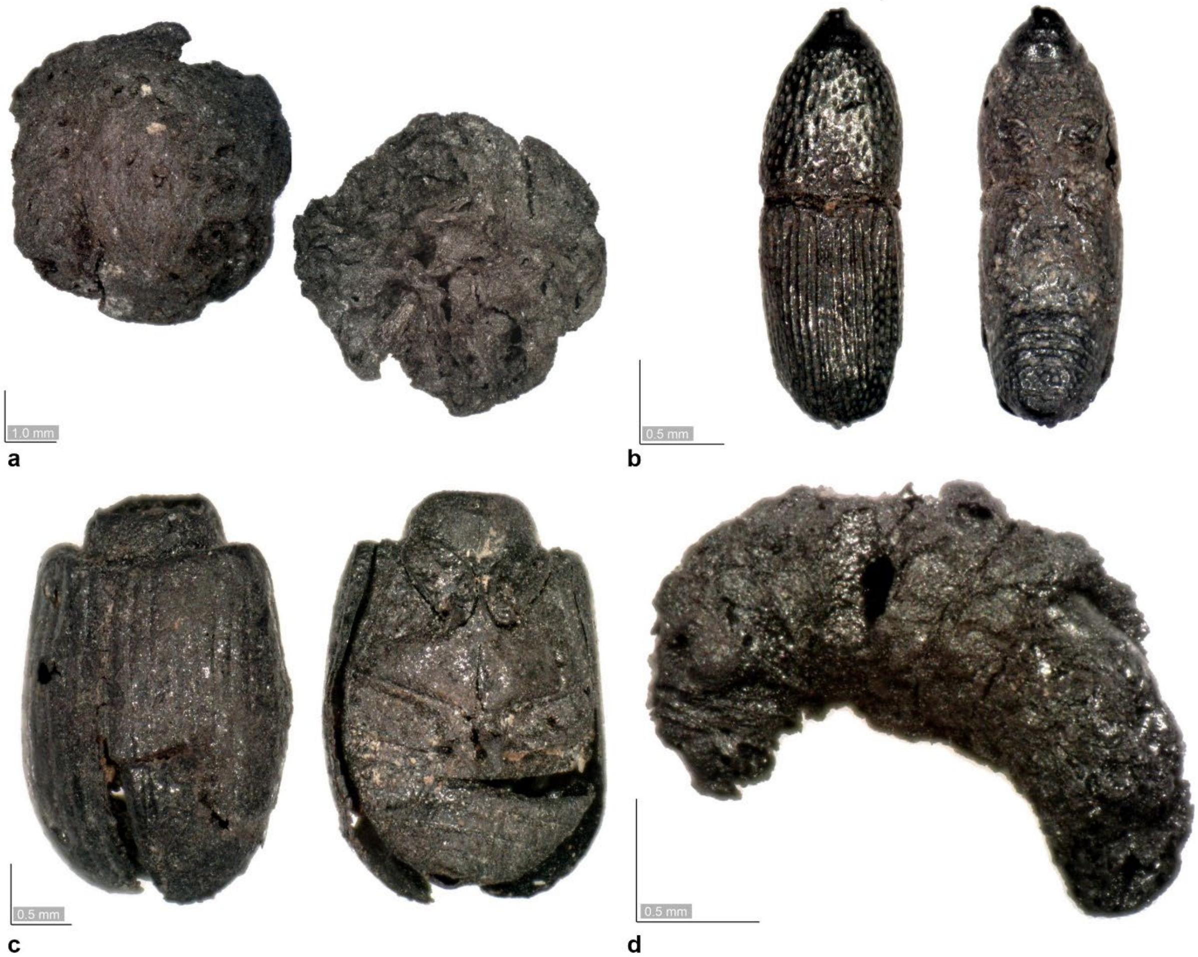


Figure 6.29 – *Miscellanea:* (*a*), *sheep/goat dung pellet* (*KIN14B2031s133*)*;* (*b*)*,* Sitophilus granarius (KIN14B2032s135a)*;* (*c*)*, unknown insect* (*KIN14B2032s135a*)*;* (*d*)*, unknown larvae* (*KIN14B2002s105*)*.*

6.4 Discussion: agriculture, diet, and vegetation in the landscape of Niğde-Kınık Höyük

Having presented the results of the carpological study, in this section, I will discuss the main trends detected in the assemblage from Niğde-Kınık Höyük. A practical way to start this analysis is by discussing the multivariate plots elaborated for the economic (Figure 6.30) and wild/weedy (Figure 6.31) taxa.

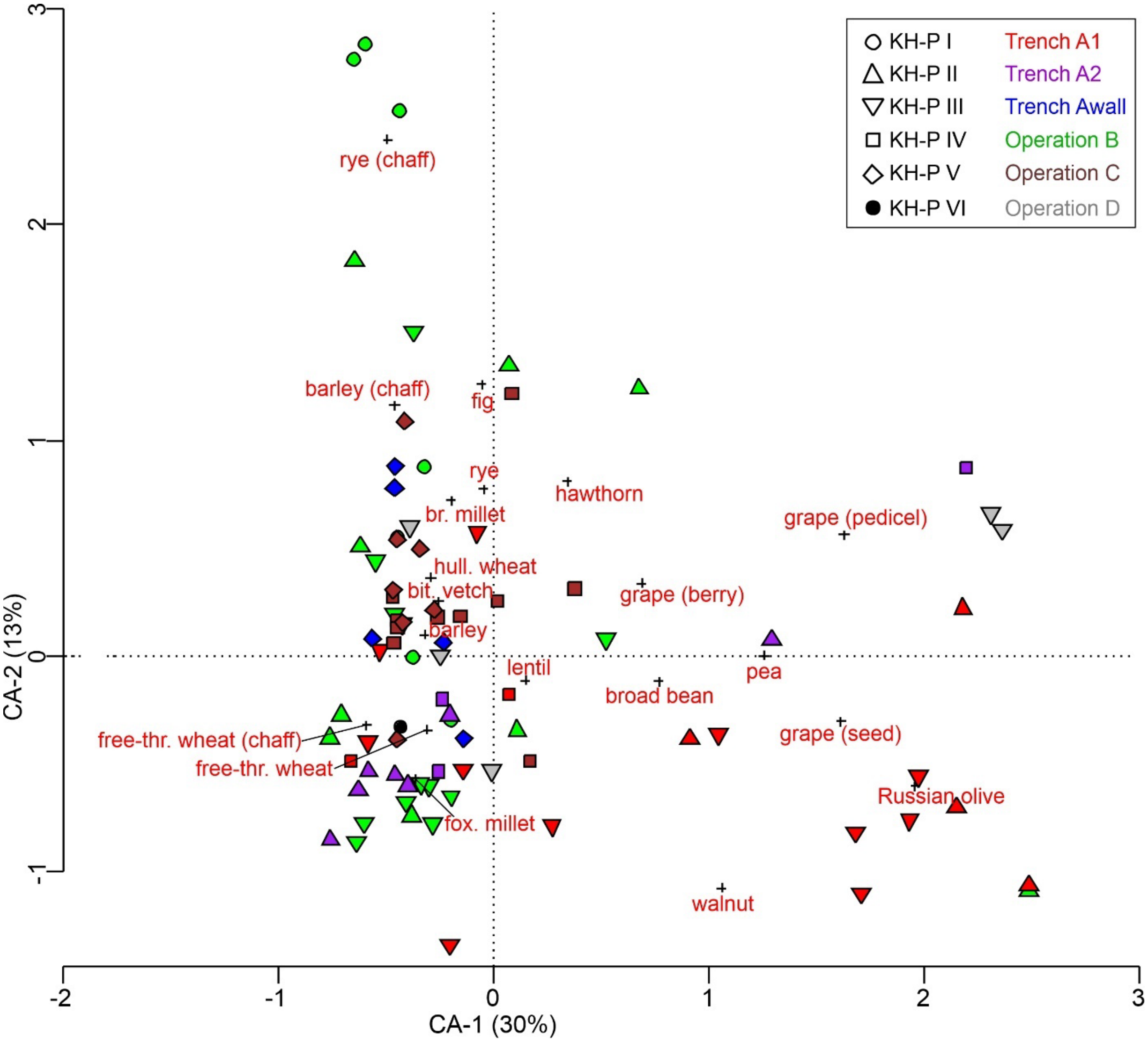


Figure 6.30 – Correspondence Analysis (CA), economic taxa. For methods see Section 6.2.4. Symbols indicate the occupation period, while colors the trench/operation.

The Correspondence Analysis (CA) plot presented in Figure 6.30 summarizes the economic plants' record. In the figure, samples are distinguished both based on operation/trench and occupation period (Table 6.1). The first axis (CA1), which accounts for 30% of the variance, can be interpreted as dividing cereals from fruits and nuts rich samples, with the latter correlated to positive values on the axis (Figure 6.30). The second axis (CA2), which explains 13% of the variance, appears to separate samples dominated by wheat from samples dominated by barley, the latter associated to positive values on this axis. In the graph, millets and rye are located by the elaboration in the same quadrant of barley (Figure 6.30).

The CA plot of economic plants (Figure 6.30) corroborates the presence of both chronological and spatial trends underlying the detected variance. Acknowledging an expected degree of sample specific variability, the samples dated to period KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE) are located by the elaboration in the quadrant of the plot correlated to a higher contribution of both fruit-nut taxa and free-threshing wheat. On the contrary, the samples originating from the earlier phases of the sequence (KH-P VA and KH-P VB; from 1200 to 800 BCE) are located in the quadrant defined by higher concentrations of barley and a lower contribution of fruit-nut taxa (Figure 6.30). Samples attributable to period KH-P IV (800-500 BCE) appears to be partially overlapping in between the two aforementioned groups. While samples dated to the Medieval occupation of the site (KH-P I, 1200-1450 CE) are scattered in the plot, nevertheless tending to be ubicated in the portion of the graph associated to rye and barley (Figure 6.30).

In addition to the aforementioned diachronic trend, the multivariate plot (Figure 6.30) can be further interpreted based on the spatial (operation/sector; Section 3.4.3) and contextual origin of the samples. It is observed that the samples originating from Trench A1 are associated to high values of fruits and nuts, while samples from the other locations of the site (Operation B, Operation C, Operation D, Trench A2, and Trench Awall) are plotted in an area of the graph associated to cereals.

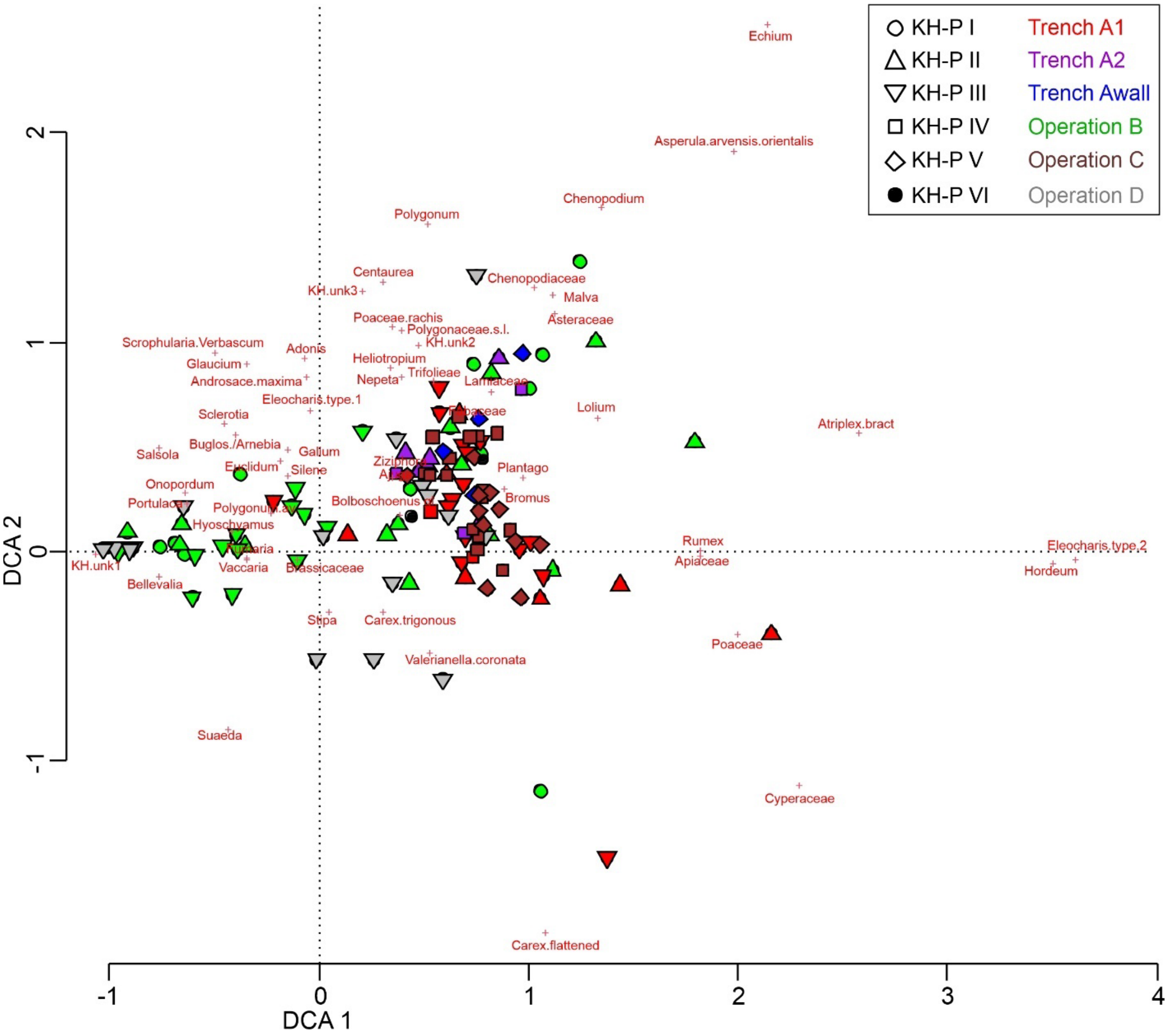


Figure 6.31 – Correspondence Analysis (CA), wild and weed taxa and unknown types. Computation is based on concentration values. For methods see Section 6.2.4. Symbols indicate the occupation period, while colors the trench/operation.

In Figure 6.31, I present the multivariate plot (Detrended Correspondence Analysis, DCA) of the wild and weed taxa and unknown types. The interpretation of this elaboration is challenged by a more marked sample-by-sample variability, floristic richness, and differences in identification levels. The first axis of the DCA appears to be correlated to the abundance of KH-unk1 (Section 6.3.5), which characterize samples from the latest periods (KH-P III, IIB, and I); an exception are the samples from Trench A1, once again divorced from evidence originating from elsewhere at the site (Figure 6.31).

Having recognized the presence of differences in the dataset attributable to both the chronological and the spatial origin of the samples, in the next sections I will further elaborate on the main diachronic trends (Sections 6.4.1 and Section 6.4.2), for then providing a discussion based on the contextual provenience of the materials here considered (Section 6.4.3).

6.4.1 *The diachronic trend in agricultural production at Niğde-Kınık Höyük*

As noted in Section 6.3.3, free-threshing wheat and two-rowed hulled barley are the dominant staple crops throughout the entire sequence (Figure 6.9). As I will discuss in Chapter 7 of the dissertation, this duopoly is to a large extent expected in 1st millennium BCE western Asia.

Throughout the entire sampled sequence (1600 to 1 BCE, and 1200 to 1450 CE), barley grains and rachis are overwhelmingly identified as two-rowed hulled varieties, which thus represented the dominant barley cultivar at Niğde-Kınık Höyük (Section 6.3.3). The extreme paucity of naked barley is highly expected at this chronological stage, considering that naked barley fell out of use after the Chalcolithic period both in Anatolia (Marston and Castellano 2021: 344-345) (Chapter 7) and elsewhere in western Asia (Lister and Jones 2013). Barley could be used as staple for human consumption, for beer brewing, or as fodder. The latter purpose is traditionally prominent in western Asia (e.g., Miller 1997, with references). Under optimal growing conditions, poly-rowed barley returns higher yields than 2-rowed varieties (e.g., Hillman 1973). The former, however, requires higher moisture levels in order to reach full maturation, a requirement that in semi-arid contexts generally implies the presence of a degree of irrigation (Harlan 1968). In dry farming, six-rowed barley could still be cultivated as fodder, maximizing chaff production. Two-rowed varieties, on the other hand, are traditionally favored for beer brewing, due to their higher starch percentage and lower protein content (Riehl 2019: 9). With the current available evidence, it is impossible to pinpoint whether the two-rowed barley from Niğde-Kınık Höyük would have been cultivated for fodder or if it was rather destined to human consumptions, either in form of grain products or beer. It is, nevertheless, reasonable to assume the presence of different destinations, with perhaps an emphasis towards specific uses impacted by the year-to-year variability in yields, as discussed below.

Compared to wheat, domesticated barley has a shorter vegetative cycle, and it is more tolerant to both salinity and aridity (Riehl 2019: 3). Because of these characteristics, barley is regarded as a crop well-suited for cultivation in semi-arid environments, prone to water deficit (e.g., Riehl 2009 and 2019, with further references). In rain-fed agriculture, the dual cultivation of wheat and barley, in different fields or mixed (maslins), is a traditional strategy aimed at mitigating climate-derived variability and unpredictability in yields (Marston 2011). Ethnographic evidence indicates that in maslin fields the portion of the barley yield to be destined to human consumption varies year by year: when yields are abundant, the harvest is sorted by sieving, the resulting wheat rich-fraction is used for human consumption, while the barley-rich product is destined to feed animals. On the contrary, in less favorable (drier) years, the entire yield is saved for human consumption, and the hay can still be used as fodder (Halstead and Jones 1989: 52, Jones and Halstead 1995: 109, Marston 2011: 192).

Throughout the period covered by this study, free-threshing wheat (*Triticum aestivum/durum*) was undoubtedly a central component of the local diet. In comparison to barley, wheat is more commonly preferred for human consumption. In post-Bronze Age Anatolian sites, it is expected to register a dominance of free-threshing wheat over hulled species (Marston and Castellano 2021: 344-345). It is, thus, somehow expected that the latter at Niğde-Kınık Höyük are attested exclusively by single finds (Figure 6.8). Hulled wheats were, thus, not part of the local 1st millennium BCE agricultural landscape. The single specimens of rachis segments and grains identified as einkorn or emmer could be accordingly either attributed to plants growing as weeds in free-threshing fields and/or as materials redeposited from earlier (Bronze Age) strata.

As discussed in Section 6.3.3, tetraploid (*Triticum durum* s.l.) and hexaploid (*T. aestivum* s.l.) free-threshing wheat can be distinguished in well-preserved rachis internodes. Based on chaff remains (Table 6.15), the wheat assemblage from Niğde-Kınık Höyük is dominated by bread wheat (hexaploid, *T. aestivum* s.l.), with only a sporadic occurrence of the macaroni (tetraploid, *T. durum*) morphotype. As already noted, free-threshing wheat is more water demanding than barley. The response to water deficit varies between tetraploid (*T. durum* s.l.) and hexaploid (*T. aestivum* s.l.) wheat, with the latter having a comparatively low water-holding capacity (Percival 1974, Riehl 2009). Bread wheat (*T. aestivum*) is, accordingly, considered better suited for cultivation in regions with annual rainfall > 400 mm, with an increase in yields expected to occur if wetter conditions are present (Riehl 2009).

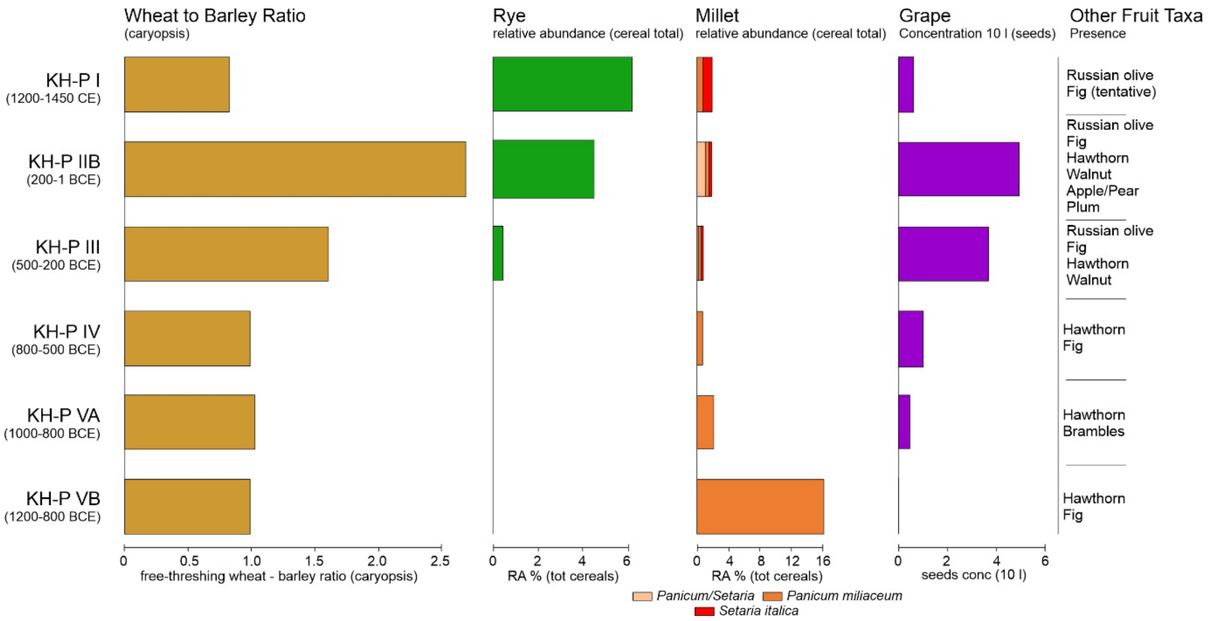


Figure 6.32 – Main trends in economic taxa: free-threshing wheat (Triticum aestivum/durum) *to barley* (Hordeum vulgare) *ratio, calculated on caryopsis count values; relative abundance of rye* (Secale cereale) *and millets* (Panicum miliaceum *and* Setaria italica)*, calculated using as sum the total of the cereal grains identified; grape* (Vitis vinifera) *concentrations* (*items for 10-liter sample*)*, and other fruit and nut taxa identified in each occupation period.*

Although 2-rowed hulled barley and free-threshing wheat are the dominant crops throughout the entire period here considered (Section 6.3.3), the ratio between the two crops defines a clear chronological trend: during the Iron Age (KH-P VB to KH-P IV; 1200-500 BCE) barley and wheat grains are approximately equally attested, during periods KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE) wheat significantly increases and barley decreases, relatively speaking (Figure 6.13 and 6.32). Considering the aforementioned growing requirements of free-threshing wheat, and more specifically of bread wheat (*Triticum aestivum*), this trend may potentially be indicative of an expansion of cultivation of more valuable yet more water-demanding crops.

In addition to wheat and barley, three other cereal crops are attested in the sequence:

broomcorn millet (*Panicum miliaceum*), foxtail millet (*Setaria Italica*), and rye (*Secale cereale*) (Figure 6.32). Both foxtail and broomcorn millet are East Asian domesticates (Stevens et al. 2021, with literature). The hypothesis of two Eurasian centers of domestication has been, in fact, recently fully dismissed (Filipović et al. 2020). Leaving aside single identifications (Middle Chalcolithic levels at Mersin-Yümüktepe; Fiorentino et al. 2014), millet is found in Anatolian sites, although in small numbers, starting from the Middle Bronze Age (2000-1600 BCE), for then becoming comparatively widespread during and after the Iron Age (Miller et al. 2016, Marston and Castellano 2021) (Chapter 7). Millet is a summer crop, which cultivation under Mediterranean climate (dry hot summer, and cold/cool wet winters) implies the presence of a degree of artificial watering (Miller et al. 2016). In the record from Niğde-Kınık Höyük broomcorn is found more abundantly than foxtail millet, with the latter attested only in single grains. In the sampled sequence, Period KH-P VB (1200-1000 BCE) is the only occupation phase in which millet is found in significant values (Figure 6.32), suggesting that at that time it was cultivated in the landscape surrounding the site.

At Niğde- Kınık Hoyük, rye (*Secale cereale*) appears to have acquired an economic importance only during the later periods here considered (Figure 6.32). Leaving aside single attestations from period KH-P III (500-200 BCE), rye is more commonly found, both in form of caryopsis and rachis segments, during period KH-P IIB (200-1 BCE) and KH-P I (1200-1450 BCE). With the expansion of rye cultivation at a later chronological stage, these data agree with the evidence available from elsewhere in Anatolia, including both archaeobotanical (Marston and Castellano 2021) and palynological (e.g., England et al. 2008) data.

Although found in limited quantities, pulses were a component of the local diet, as indicated by their ubiquitous presence in the analyzed samples (Figure 6.17). As discussed in Section 6.3.3, the two pulses most abundantly attested are lentils (*Lens culinaris*) and bitter vetch (*Vicia ervilia*), which most certainly represented two locally farmed crops. The other pulses attested, in lower numbers, are common pea (*Pisum sativum*), chickpea (*Cicer arietinum*), and broad bean (*Vicia faba*) – the latter two taxa documented only in single specimens. A taxonomically limited assemblage, with emphasis on bitter vetch and lentils, is consistent with the broader central Anatolian archaeobotanical record (Marston and Castellano 2021) (Chapter 7). Bitter vetch and lentils could have been favored in central Anatolia over other pulses due to their lower moisture requirements (Riehl 2009: 98). Although currently cultivated for fodder, bitter vetch formerly represented an important crop for human consumption. Because of a toxin presents in the seeds, they require soaking, leaching, and steaming in water in order to become palatable to humans (Zohary et al 2000: 92). The diachronic trend in pulses attestation indicates an increased importance of these crops during the latest periods of the sequence – KH-P III (500-200 BCE), KH-P IIB (200-1 BCE), and KH-P I (1200-1450 CE) – as it is suggested by a significant increase in pulses ubiquity and the introduction of new crops (pea, *Pisum sativum*; broad bean, *Vicia faba*).

A clear chronological trend is observable also in the fruit and nut record, which is driven by grape (*Vitis vinifera*) (Figure 6.20). The attestation of *Vitis vinifera* seeds, pedicels, and charcoal in samples dated to period KH-P VA (1000-800 BCE) indicates that viticulture was already established in the surrounding of the site during the Early Iron Age. A dramatic increase in *Vitis* is recorded during period KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE). This trend is consistent across the different types of *Vitis* macro-remains – i.e., grapevine charcoal (Section 5.4.3), and grape seeds and pedicels (Figure 6.20).

In central Anatolia grapevine cultivation necessitates a degree of watering in the summer (hot and dry) season (Gorny 1995). Grapevines have, in fact, a low drought tolerance, requiring in hot climates between 500 and 1200 mm of rainfall during the growing season, extending from February to July (Riehl 2009: 98). Furthermore, it is common practice to irrigate vineyards in the first years after planting, until the root system reaches full development. Under the semi-arid conditions of the central Anatolian plateau, it is thus implied that vineyards are planted in plots in which moisture originating from rainfall is either naturally enhanced (e.g., wet soils in riparian habitats) or supplemented by means of irrigation. The considerations previously made on the basis of the cereal record, reconstructing a coherent phase of expansion of water demanding crops starting (at least) with period KH-P III (500-200 BCE), can be accordingly further corroborated (Figure 6.32).

The increase in grape remains is couple by the introduction of new arboreal crops, such as Russian olive (*Elaeagnus angustifolia*) and walnut (*Juglans regia*). Both taxa are first attested in carpological record during period KH-P III (500-200 BCE), matching their earliest occurrence in the wood charcoal sequence (Section 5.4.3). As already noted in Section 5.4.3, Russian olive is currently commonly attested in southern Cappadocia along canals and roads. The fruits of Russian olive are palatable, highly nutritious, and particularly rich in sugars (fructose and glucose; Bartha and Csiszar 2008: 89-90). These fruits are either consumed fresh, dried, or fermented in alcoholic products. Russian olive is still a comparatively important crop in Iran, where it is known as *Sinjad*/*Sinjid*. Although highly valued and appreciated across Central and Middle Asian countries, the taste of *Elaeagnus angustifolia* fruits could be not appealing to everyone, quoting the Scottish botanist J. Aitchison: "*Much cultivated in orchards* [the author refers in particular to Afghanistan] *for its fruit, which to a European palate does not seem worth eating, to me resembling in the mouth a mixture of dry cotton wool and ashes*" (Aitchison 1891: 63).

The evidence from Niğde-Kınık Höyük provides the earliest attestation known to date of botanical macro-remains (charcoal and endocarps) of *Eleaegnus angustifolia* in Anatolia. This taxon is otherwise attested elsewhere in Asia Minor in Byzantine (endocarps from the Yenicapi-Marmary shipwrecks; Oybak-Dönmez 2010) and Medieval (wood charcoal from Aşvan; Willcox 1974) contexts. On the contrary, more extensive archaeobotanical evidence of *Elaeagnus* is found in Central Asia (Hovsepyan and Willcox 2008, Smith et al. 2004, Spengler 2018, Spengler and Willcox 2013). These considerations allow to speculate on a possible introduction of Russian olive from this latter region, perhaps around the time of the incorporation of Anatolia under the Achaemenid Empire.

A brief note should be made also regarding what is missing in the carpological assemblage from Kınık Höyük. In the entire record, I did not recover a single olive (*Olea europaea*) endocarp, which confirms wood charcoal evidence in pointing out that *Olea europaea* was not part of the local agricultural landscape in the time periods here investigated – the regional implications of which have already been discussed in Chapter 5.5. Flax (*Linum usitatissimum*) is attested only by a single seed, indicating a very marginal importance of this crop in the agricultural landscape of Niğde-Kınık Höyük. This marginality could be explained by a preference towards wool as a textile fiber, which is well within agreement of the zooarchaeological record (Crabtree and Campana 2016, Castellano et al. forthcoming). Finally, we should note that, as largely expected based on phytogeography (Davis 1967: 524), jujube (*Ziziphus* spp.) remains are not documented at Kınık Höyük nor elsewhere in Anatolia – oddly contradicting Pliny the Elder who describes jujube as the “the tree of Cappadocia” due to an allegedly widespread presence in the region (*Naturalis Historia* XXI:27).

6.4.2 *The diachronic trend in the wild and weed assemblage*

Based on preferred habitats, wild and weedy flora could be divided into arable (i.e., weeds) and non-arable taxa, with the latter growing in ruderal (e.g., waste area, field borders, and roadsides) and undisturbed (e.g., growing on steppe, woodlands, and marshes) environments. These distinctions are, however, far from being always feasible: several taxa are, in fact, adapted to thrive under different ecological conditions (e.g., Filipović 2014: 55). This intrinsic ecological difficulty in pinpoint taxa-specific habitats is further exacerbated by the taxonomic level of several identifications, which are often above the species level (e.g., Fairbairn et al. 2007: 470).

Following the approach outlined, among others, by Filipović (2014), in Table 6.24 I reported the preferred habitats of the wild and weed taxa identified in the assemblage, using the *Flora of Turkey* (Davis 1966-1985) as the main source of ecological information. A first distinction is made between taxa which prefer dry or wet environments, in the latter it is specified whether the plant favors freshwater or saline conditions. Taxa adapted to dry conditions are assigned to arable land, ruderal areas, and various undisturbed environments. Most taxa, as already discussed, are attributed to more than one habitat.

		Dry					Wet	
		Arable	**Ruderal**				**Freshwater**	**Saline**
		field and cultivated land	waste places, roadsides, ditches	rocky slopes, screes, hillsides	steppe, grassland	clay soils, sandy places	river or lake banks, marshes, stagnat water	salty places, salt marshes
	Wild and weedy plant							
Alismataceae	*Alisma* sp.						x	
Apiaceae	*Apium* -type	x					x	
	Bifora radians	x	x					
	Bupleurum -type	x	x	x	x		x	x
	Torilis sp.	x	x	x			x	
Asteraceae	*Artemisia* sp.	x	x		x	x		
	Aster-type			x		x		
	Calendula sp.	x	x	x				
	Carduus nutans-type	x	x	x	x			
	Centaurea sp.	x	x	x	x	x		
	Cichorium sp.	x	x	x	x			
	Crepis- type	x	x	x	x		x	
	Onopordum sp.	x	x	x	x			x
	Scorzonera sp.	x	x	x	x		x	x
Boraginaceae	*Buglossoides tenuiflora*			x				
	Buglossoides arvensis /Arnebia decumbens	x	x	x	x			
	Echium sp.	x	x	x	x	x		
	Heliotropium sp.	x	x	x	x			
	Onosma sp.	x	x	x	x			
	Symphytum- type			x			x	
Brassicaceae	*Alyssum*- type	x	x	x	x			
	Brassica- type	x	x	x	x			
	Camelina-type	x	x	x				
	Cardaria draba	x						
	Conringia-type	x	x					
	Descurania-type		x					
	Euclidum syriacum	x			x			
	Lepidium sp.	x	x	x	x		x	x
	Lepidium perfoliatum	x	x	x	x			
	Neslia paniculata	x	x	x				
Caryophyllaceae	*Buffonia* sp.	x		x				
	Silene sp.	x	x	x	x			
	Gypsophila sp.	x	x	x	x			x
	Vaccaria pyramidata	x			x			
Chenopodiaceae	*Atriplex* sp.	x	x		x	x	x	x
	Beta sp.	x	x		x			
	Chenopodium murale- type	x	x	x				
	Chenopodium sp.	x	x					
	Salsola sp.							x
	Suaeda sp.	x	x			x		x
Cistaceae	*Helianthemum* sp.			x	x	x		
Convolvulaceae	*Convolvulus* sp.	x	x	x	x	x	x	
Cyperaceae	*Bolboschoenus glaucus*						x	
	Bolboschoenus sp.						x	
	Carex spp. (flattened)	x	x	x			x	x
	Carex spp. (trigonous)	x	x	x			x	x
	Cyperus sp.						x	
	Cyperus longus- type						x	
	Eleocharis sp.-type 1				x		x	x
	Eleocharis sp.-type 2				x		x	x
	Fimbristylis sp.						x	
	Scirpoides holoschoenus						x	x
Dipsacaceae	*Dipsacus* -type	x	x	x			x	
	Cephalaria -type	x	x	x	x		x	
	Scabiosa sp.	x	x	x	x	x		
Euphorbiaceae	*Euphorbia falcata*- type	x	x	x	x		x	
	Euphorbia taurinensis -type	x	x	x	x		x	
Fabaceae	*Astragalus*- type	x	x	x	x	x		
	Medicago radiata				x			
	Medicago- type	x	x	x	x			
	Melilotus- type	x	x					

		field and cultivated land	waste places, roadsides, ditches	rocky slopes, screes, hillsides	steppe, grassland	clay soils, sandy places	river or lake banks, marshes, stagnat water	salty places, salt marshes
	Trifolium- type	x	x	x	x		x	
	Trigonella- type	x	x	x	x			
	Coronilla-type	x	x	x		x		
Lamiaceae	*Ajuga chamaepitys*	x	x	x	x			
	Ajuga- type	x	x	x	x			
	Lallemianta -type	x	x	x			x	
	Mentha sp.						x	
	Nepeta sp.	x	x	x			x	
	Stachys- type	x	x	x	x		x	
	Teucrium -type		x	x	x			
	Ziziphora sp.		x	x	x			
Liliaceae	*Allium* -type	x		x			x	
	Bellevalia sp.	x	x	x	x		x	
	Ornithogalum sp.	x	x	x			x	
Malvaceae	*Malva* sp.	x	x		x			
Papaveraceae	*Fumaria* sp.	x	x					
	Glaucium sp.	x	x	x	x			
	Papaver sp.	x	x	x	x			
Plantaginaceae	*Plantago* sp.	x	x	x	x	x	x	x
Poaceae	*Aegilops* sp.	x	x	x	x			
	Bromus sp.	x	x	x	x			
	Eremopyrum sp.		x	x	x	x		
	Festuca- type			x	x		x	
	Hordeum sp. (wild)	x	x	x	x			
	Lolium sp.	x	x	x		x		
	Micropyrum -type			x	x			
	Phalaris sp.	x	x	x			x	
	Poa bulbosa			x	x			
	Setaria viridis /*verticillata* -type	x	x					
	Stipa sp.			x	x			
	Taeniatherum caput-medusae			x	x			
Polygonaceae	*Persicaria* -type						x	
	Polygonum convolvulus	x	x	x				
	Polygonum aviculare s.l.		x	x				
	Rumex sp.	x	x	x			x	
Portulacaceae	*Portulaca oleracea*	x	x					
Potamogetonaceae	*Potamogeton* sp.						x	
Primulaceae	*Androsace maxima*			x				
Ranunculaceae	*Adonis* sp.	x	x	x	x			
	Ceratocephalus falcatus			x	x			
	Ranunculus sp.	x		x			x	
Resedaceae	*Reseda lutea* -type	x	x	x				
Rosaceae	*Sanguisorba* sp.	x	x	x			x	
Rubiaceae	*Asperula arvensis* /*orientalis*	x	x	x	x			
	Galium sp.	x	x	x	x			
Scrophulariaceae	*Veronica dillenii-type*			x		x		
	Veronica hederifolia	x		x				
	Veronica polita -type	x	x	x	x			
	Veronica triphyllos	x	x	x		x	x	
Solanaceae	*Hyoscyamus* sp.	x	x	x				
	Solanum sp.	x	x	x		x	x	
Thymelaeaceae	*Thymelaea* sp.	x		x	x	x		
Valerianaceae	*Valerianella coronata*- type	x		x				
	Valerianella vesicaria- type	x		x				
Zygophillaceae	*Peganum harmala*		x		x			

Table 6.24 – *Habitat preferences for the wild/weed taxa.*

As reported in Table 6.24, several members of the sedges (Cyperaceae) family favor humid conditions, representing one of the main components of the herbaceous riparian flora. These taxa could be, thus, tentatively associated to the humid ecosystems, which would have been present in the surroundings of Niğde-Kınık Höyük (Section 3.1.3), to irrigation canals/ditches sides, and other moisture-rich contexts.

In Figure 6.33 it is reported the relative abundance of Cyperaceae achenes during each occupation period. A first peak in the relative abundance of Cyperaceae is documented in period KH-P VB (1200-1000 BCE), which is followed by a drop, and a second peak during KH-P III (500-200 BCE). *Bolboschoenus glaucus* is attested in significant values only during the earlier portion of the sequence, from KH-P VB to KH-P IV (1200-500 BCE), while *Eleocharis* spp. appears to increase in importance during the latter periods.

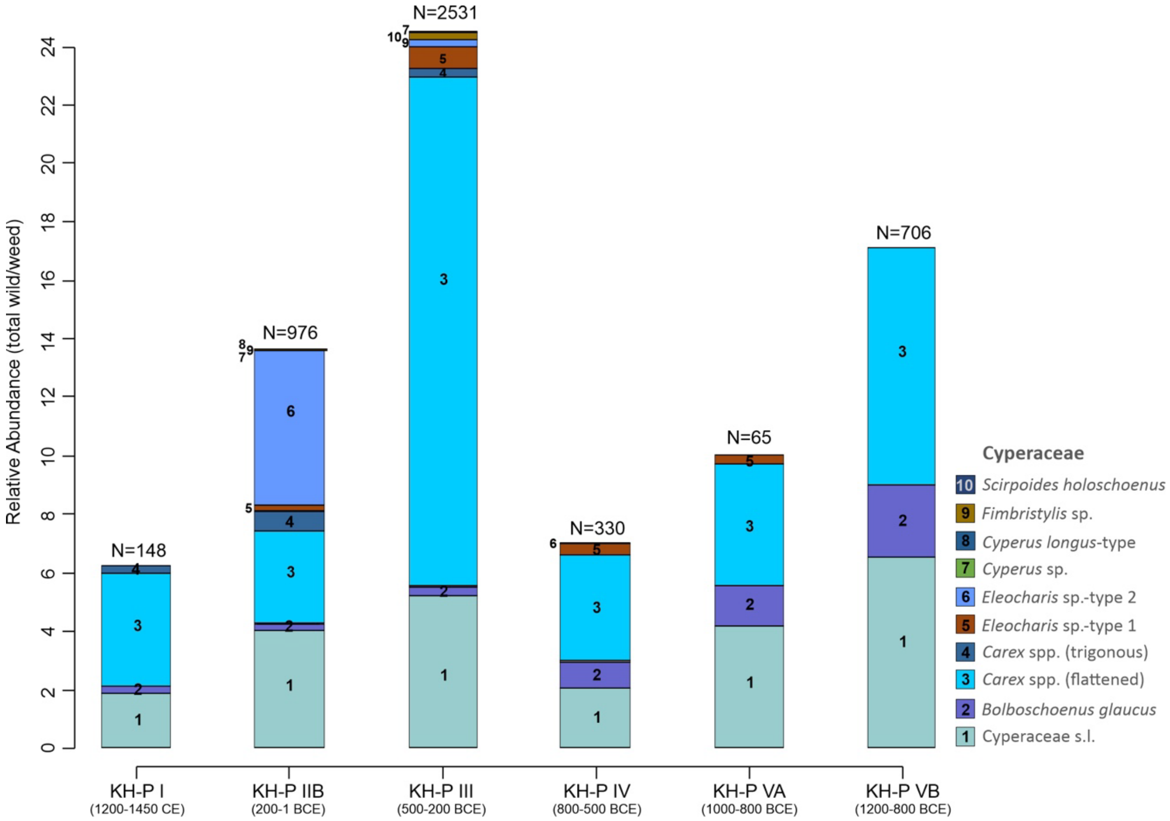


Figure 6.33 – Relative abundance of Cyperaceae, calculate using as sum the total count of wild and weedy taxa seed/fruit (excluding unknowns). N= number of specimens attributed to the family.

Bolboschoenus glaucus grows preferably in freshwater environments (Hroudová et al. 2007), while some members of the *Eleocharis* genus and other sedges tolerate also halophytic environments (Davis 1985: 48-53). It might be possible, thus, to tentatively hypothesize that freshwater habitats were more extensively present in the earlier portion of the sequence here investigated, until the mid-1st millennium BCE. It would be tempting to correlate these possible changes in the humid ecosystems present in the surrounding of the site to the hydrographic and ecological impact of water management works conducted on the landscape surrounding the site, as it would suggest the expansion of the cultivation of water-demanding crops (Section 6.4.1) and the drop of wood charcoal from riparian vegetation (Section 5.4.1) – this hypothesis is, however, speculative.

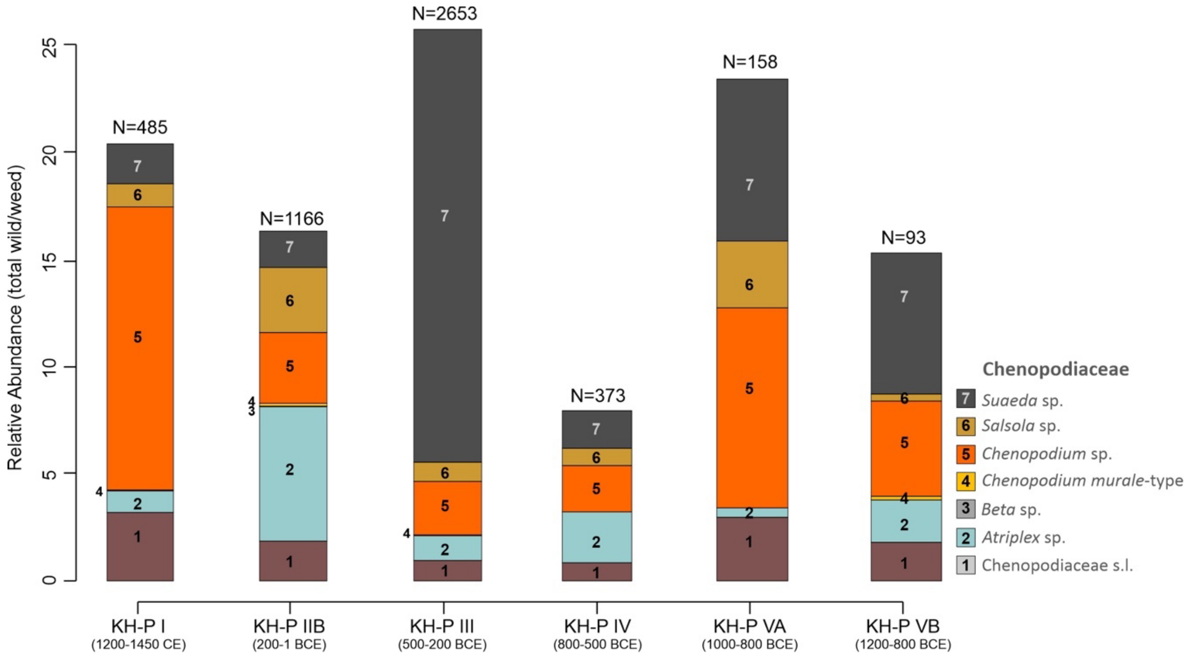


Figure 6.34 – Relative abundance of Chenopodiaceae, calculate using as sum the total count of wild and weedy taxa seed/fruit (excluding unknowns). N= number of specimens attributed to the family.

In Figure 6.34, I summarize the diachronic trend of the Chenopodioideae (goosefoot subfamily), a second clade that is abundant in the sequence. As it is possible to notice, important fluctuations are present, with different taxa acquiring importance in different periods: *Suaeda* sp. in period KH-P VB, VA, and III; *Salsola* sp., during KH-P VA and IIB; and *Chenopodium* sp. in period KH-P VA and I. To some extend these fluctuations can be ascribed to the large number of seeds produced by these taxa, which could lead to their overrepresentation. *Salsola* sp. (saltwort) is particularly well-adapted to grow on salty soils (Davis 1967: 328-334). In addition to saltwort, also *Suaeda* spp. and several species of *Atriplex* and *Chenopodium* are halophytic (Davis 1967). This evidence might, thus, indicate the presence of saline environments in the surroundings of Niğde-Kınık Höyük, which are highly expected considering the hydrological layout of the region (Section 3.1.3), with the presence of extensive salty marshes documented until the mid-20th century (Section 3.1.4). In addition to halophytic conditions, Chenopodioideae are further often encountered on dry, rocky, poor soils (e.g., Miller 2010).

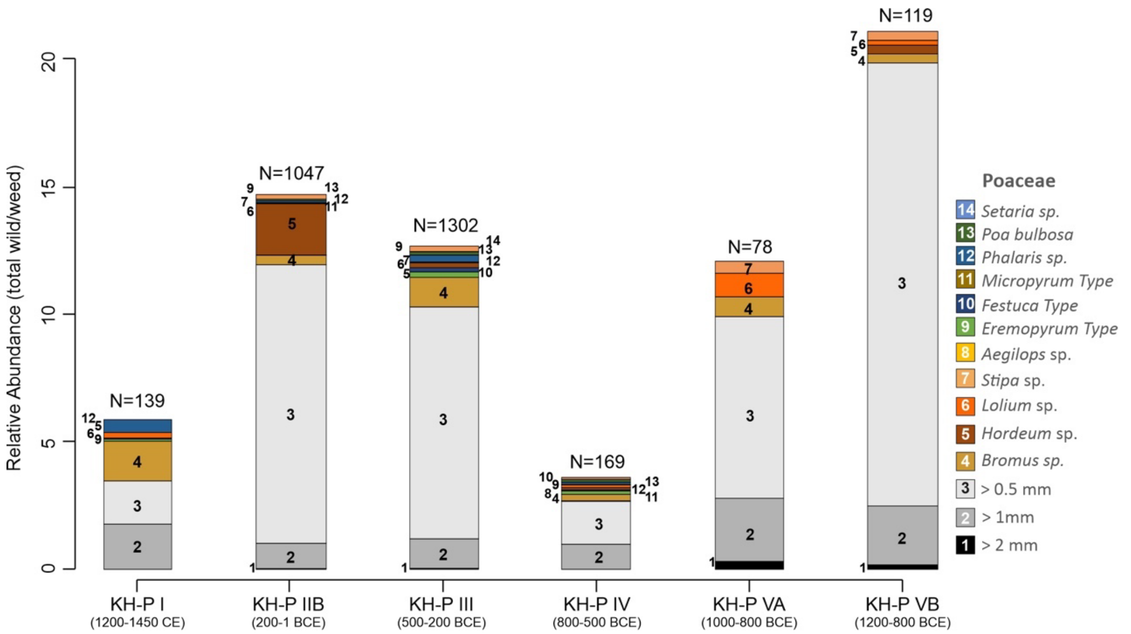


Figure 6.35 – Relative abundance of Poaceae, calculate using as sum the total count of wild and weedy taxa seed/fruit (excluding unknowns). N= number of specimens attributed to the family.

Poaceae (grasses) are commonly found throughout the entire sequence (Figure 6.35). The Poaceae record is dominated by small-seeded (0.5 mm fraction) grasses, of which identification is notoriously challenging and, arguably, often not possible due to a complex taxonomy and overlapping morphology (e.g., Nesbitt 2006). Larger seed grass types – such as *Lolium* spp., *Stipa* spp., *Hordeum* spp., *Bromus* spp., and *Aegilops* spp. – are found ubiquitously yet in low abundance. The increase in *Hordeum* sp. during period KH-P IIB is in part driven by a single sample (KIN14A1512s48) in which this taxon is found in comparatively high values.

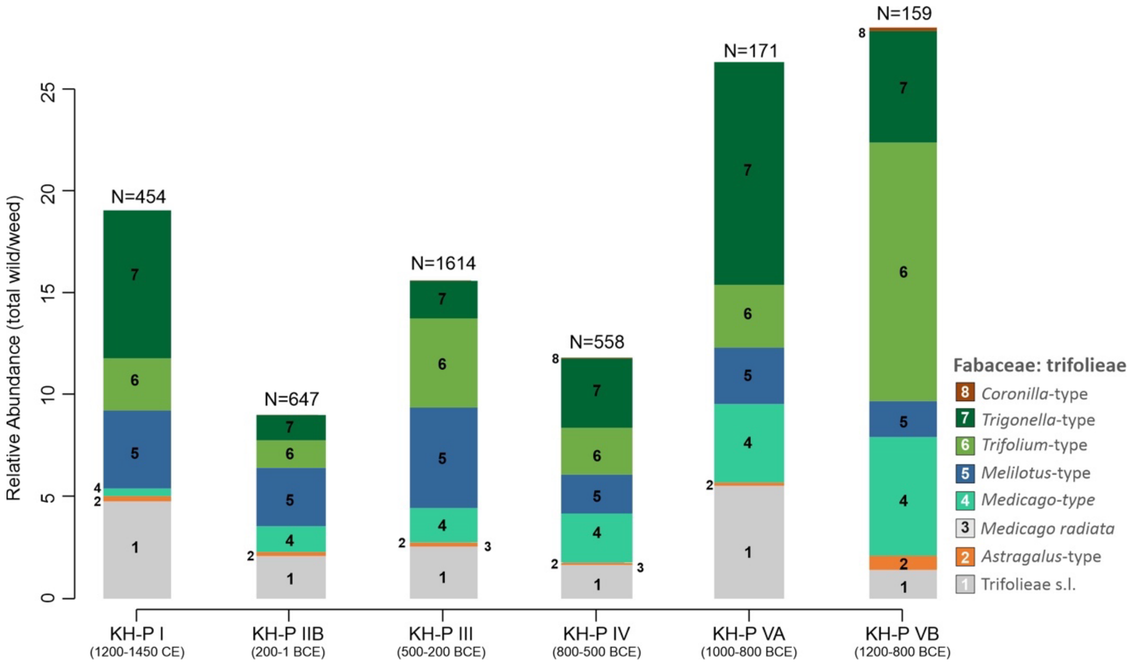


Figure 6.36 – Relative abundance of Trifolieae (Fabaceae family), calculate using as sum the total count of wild and weedy taxa seed/fruit (excluding unknowns). N= number of specimens attributed to the tribe.

Small-seeded legumes (Trifolieae) are a further common group attested in the sequence (Figure 6.36). Several types are detected in the assemblage: *Astragalus*, *Medicago*, *Melilotus, Trifolium,* and *Trigonella*. These identifications are regards as 'type' (Appendix 6), considering the strong similarities in seed anatomy between taxa (Butler 1996) and the large number of species present in Anatolia.

– *Evidence of dung burning*

As discussed in the previous sections, the archaeobotanical record from Niğde-Kınık Höyük is characterized by an abundance of wild herbaceous taxa, which are found in high concentrations (Figure 6.22), representing the dominant component in the majority of the analyzed samples (Figure 6.6). Carpological remains of wild and weed taxa could be incorporated in the archaeological deposit following four main pathways: (*i*) they could represent arable weeds harvested together with the crops (e.g., Hillman 1984, Jones 1990); (*ii*) they can originate from useful wild plants collected/used by the site inhabitants (e.g., Doğan et al. 2004); (*iii*) they could be deposited via burning of ruminant dung (e.g., Miller and Smart 1984); or (*iv*) by fully natural processes (e.g. 'seed rain') (Minnis 1981: 145-146).

Cereal processing could, thus, represent a first possible source of the non-economic plant remains (Hillman 1984 and 1985, Jones 1990, van der Veen and Jones 2006). In order to investigate this possibility, an exploratory technique is to plot wild and weed taxa in relation to rachis fragments and cereal grains (Figure 6.37), testing the possible overlap in data to the expected composition of ethnographically known assemblages (e.g., Jones 1990: 93; see also van der Veen and Jones 2006) produced during the different steps in cereal processing (e.g., Hillman 1984 and 1985). Samples from Niğde-Kınık Höyük are consistently located in proximity to the weed/wild vertex of the ternary plot, thus indicating very high quantities of wild/weed taxa coupled by a lower contribution of cereal grains and/or rachis fragments (Figure 6.37). In Jones (1990) ethnographic study of free-threshing wheat and hulled barley processing, samples dominated by weed taxa and with variable amounts of grains but lacking chaff corresponded to by-products originating from post-winnowing fine-sieving. Considering it unrealistic that the entire assemblage, regardless of context, is dominated by a single type of cereal processing by-product, I consider it more likely that the main taphonomic pathway for wild/weed seeds is represented by a source other than cereal processing. Accordingly, in the next paragraphs, I will test the alternative hypothesis that dung burning represented the main depositional pathways leading to the formation of the rich wild herbaceous seed assemblage documented at the site.

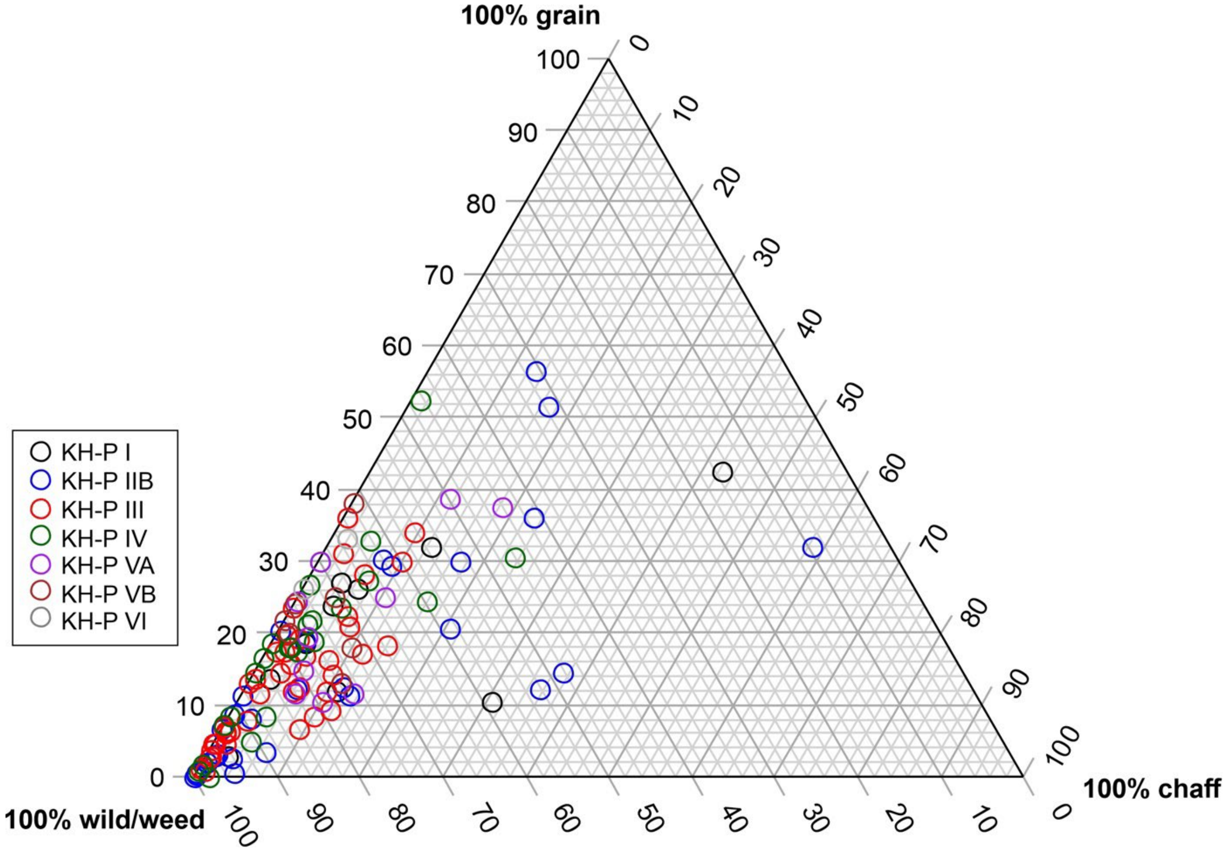


Figure 6.37 – Ternary plot showing the distribution of samples based on the proportions of cereal grains, rachis fragments, and wild/weed taxa (excluding unknowns). In the figure are represented only samples with more than 30 specimens identified for the sum of the three categories here represented. Note that the cereal assemblage is dominated by free-threshing wheat and hulled barley, making thus the results directly comparable to the observations made in Jones 1990.

The use of dung as fuel is well documented by ethnographic studies from Anatolia, western Asia, and elsewhere (e.g., Miller and Smart 1984, Anderson and Ertug-Yaras 1996, Ertug-Yaras 1997, Yakar 2000). An emphasis on the use of dung appears to be associated with poorly forested landscapes (Miller and Smart 1984), which are widespread throughout western and central Asia. Anderson and Ertug-Yaras (1996) investigated dung burning at two late 20th century central Anatolian villages – of which one, Pınarbaşı (Karaman), is located in a landscape in many regards similar to southern Cappadocia. At the time of the study, at both villages dung burning represented the main fuel source, to a variable extend complemented by firewood or (more rarely) coal (Anderson and Ertug-Yaras 1996). This ethnographic study documented the presence of a complex typology of dung 'cakes' (*tezek*), defined by the type of dung and/or the modalities of its preparation. Three main types of dung cakes were identified: (*i*) unprocessed dung or animal droppings collected from the field or the byre; (*ii*) compacted animal dung collected from the byre after winter confinement; and (*iii*) dung compacted and molded into round or rectangular cakes. A variable amount of additional material (e.g., straw) could be added to the dung cakes during preparation (Anderson and Ertug-Yaras 1996: 100-101). The authors noted that unprocessed dung is often used in order to ignite the fire, while heavy and compacted cakes are used to obtain a slow and long-lasting combustion. As noted by Anderson and Ertug-Yaras (1996: 101) and Yakar (2000: 167), tree branches, leaves, straw, and other plant parts were sometimes added to the fire as tinder or to maintain the combustion of an otherwise entirely dung-fueled fire. Although replaced to a significant extent in recent years by other sources of heating, in the Bor plain the traditional importance of dung-burning is documented (e.g., Pfeifer 1957: 78).

If the traditional use of dung as fuel in central Anatolia, and more generally across western Asia, is evident, more problematic is to identify (and quantify) the contribution of dung burning to the formation of archaeobotanical assemblages (e.g., Spengler 2019). A comparatively large literature based on experimental studies indicates that a significant portion of the carpological remains ingested by ruminants survives both digestion and the following combustion (e.g., Anderson and Ertug-Yaras 1996, Gardener et al. 1993, Valamoti and Charles 2005, Valamoti 2013, Wallace and Charles 2013). A preservation bias is, however, recorded in favor of small seeds and/or specimens with a hard and thick coat (e.g., Anderson and Ertug-Yaras 1996, Wallace and Charles 2013). Taxa adapted to dispersion through animal ingestion (endozoochoric seeds) are, furthermore, expected to be well-attested (Spengler 2019).

Miller and Smart (1984) proposed a set of criteria to be used in order to hypothesize the presence of dung-derived archaeobotanical assemblages. In their seminal contribution, the authors pointed to four main aspects to be considered: (*i*) the scarcity of wooden plants in the landscape surrounding the site; (*ii*) the presence of suitable dung-producing animals; (*iii*) the presence of charred dung pellets and/or seeds originating from forage/fodder; and (*iv*) the recovery of such items in samples originating from fire installations. In various follow-up works (e.g., Miller and Smart 1984, Miller 2010, Miller and Marston 2012), Miller and colleagues further argued for the use of the seed-to-wood charcoal ratio in order to detect and quantify the contribution of dung-burning in pyrotechnological activities – with a high ratio indicating the use of dung, while a low ratio would support a more prominent contribution of firewood. The model proposed by Miller and Smart (1984) has been further expanded by Charles (1998), who narrowed the criteria to be used in order to identify the presence of dung-burning activities, namely: (*i*) the presence of recognizable dung pellets; (*ii*) the presence of a wild and weed flora consistent with animal foraging/foddering; (*iii*) the presence of a wild/weed assemblage distinct from associations ethnographically known for crop processing by-products; and (*iv*) the presence of mixtures of crops (grain and chaff) not expected to be grown and/or processed together.

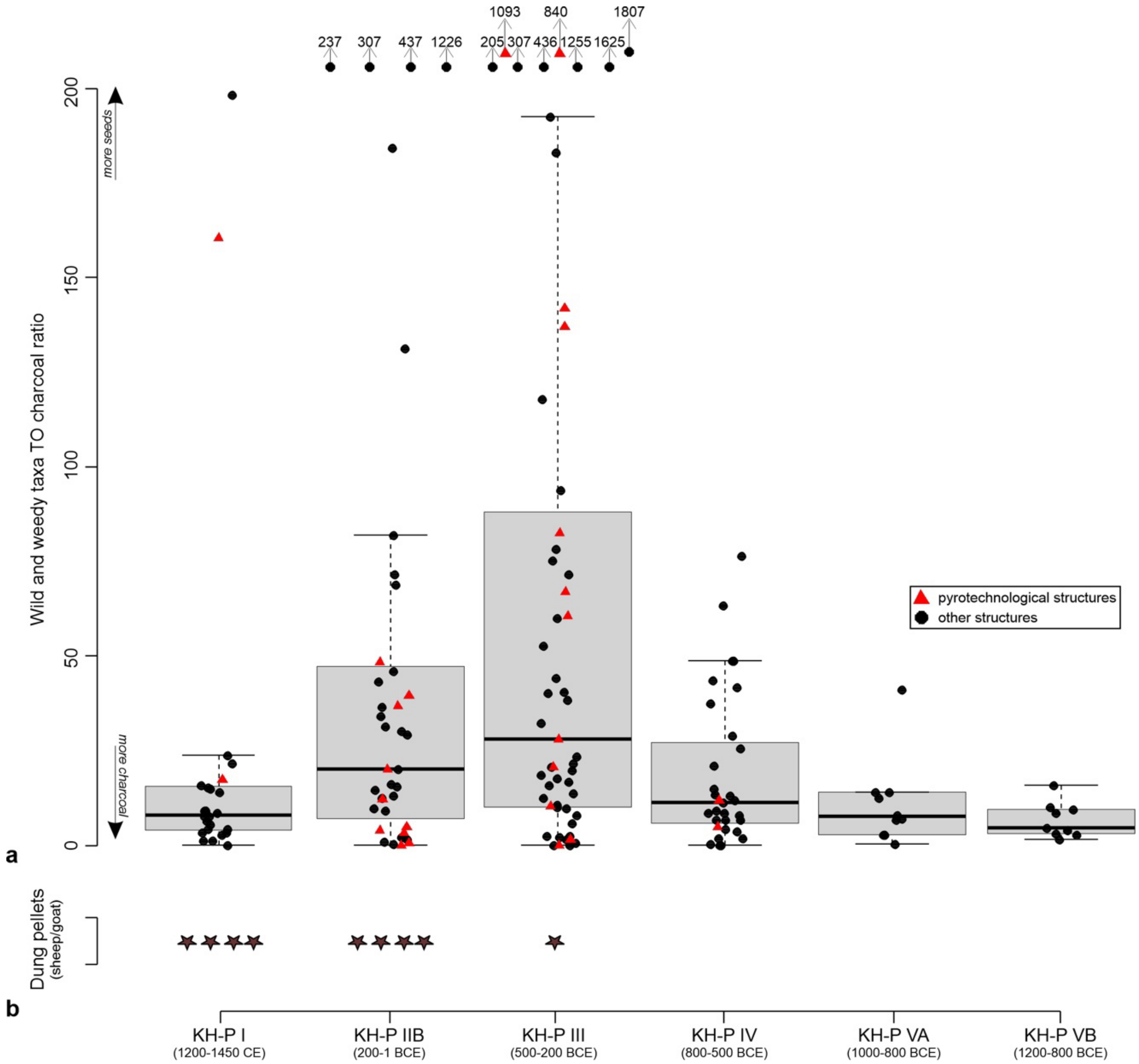


Figure 6.38 – a, wild and weed taxa (excluding unknowns) seed/fruit remains (count) to > 2 mm charcoal (weight) ratio; b, presence of sheep and goat dung pellets, each star indicating a specimen in which sheep/goat dung pellets are detected.

Returning to the assemblage from Kınık Höyük, in Figure 6.38 it is reported the seed (count, excluding unknown specimens) to charcoal (weight, > 2mm) ratio. High values indicate samples with comparatively a higher contribution of wild/weed carpological remains than wood charcoal. In the figure, samples collected from the fills of pyrotechnic installations are highlighted, considering the more direct interpretation of these contexts as originating from pyrotechnological activities. During the earlier periods, KH-P VB (1200-1000 BCE) and KH-P VA (1000-800 BCE), the ratio is lower. Starting with period KH-P IV (800-500 BCE), I have documented an increase in the ratio, which will reach particularly high values, both on average and in single samples, in the following periods KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE) (Figure 6.38). In addition to the seed-to-charcoal ratio, in Figure 6.38, I reported the number of samples in which dung pellets have been identified. As note in Section 6.3.6, dung pellets have been identified as such only in the instances of sheep/goat droppings, which in some rare cases preserve the diagnostic shape and surface texture. On the contrary, dung originating from other ruminants (e.g., cow, pig, horse, and donkey) or processed (e.g., 'cakes') likely went undetected (see also Charles 1998: 113). A sizable amount of dung fragment is, accordingly, expected to be included in the 'amorphous material' category, which analysis is not included in the dissertation. As noted by Charles (1998: 113-114) a lack of correlation between the number of pellets and the number of seeds of potentially dung origin could be explained by the progressive fragmentation of the pellets, which would result in an increase in the number of countable carpological remains released in the sample.

The majority of the identified wild/weed flora is composed of taxa palatable to ruminants. Leaving aside taxa found in single specimens (e.g., *Peganum harmala*, *Tribilus terrestris*, and *Onobrychis* sp.), the main exception is represented by *Hyoscyamus* spp. (henbane), a genus known to be toxic to both humans and livestock due to its tropane alkaloid contents (e.g., Akbaş et al. 2020). In addition of being a relatively common ruderal plant, henbane is a wild plant of known pharmaceutical use in Anatolia (Fenwick and Omura 2015) and elsewhere. Despite its toxicity, Spengler (2019: 222) reports livestock consuming fruiting black henbane (*Hyoscyamus niger*) plants, without any apparent ill effect on the animals. We cannot exclude, thus, that small amounts of *Hyoscyamus* could have been consumed by livestock, becoming part of the archaeobotanical record via dung-burning. Echoing Spengler (2019: 222), further research on heard animals grazing and browsing habits is necessary.

Other taxa found in the wild/weed assemblage are known forage and fodder plants (e.g., Ertug-Yaras 1997). Several Amarathaceae species, and in particular *Chenopodium* spp., are endozoochoric taxa (Spengler 2019); their abundance is accordingly in line with the hypothesized presence of dung-burning. As already noted (Table 6.24), the distinction between arable and non-arable flora is difficult to achieve. Taxa favoring wetlands or saline environments are, nevertheless, less likely to originate from agricultural fields. Conversely, they can be associated to livestock pasturing on these environments. A degree of intrusion of these taxa into arable fields is, however, to be expected (Filipović 2014: 87). As noted by Filipović (2014: 88) seeds of aquatic plants, such as *Alisma* sp. and *Potamogeton* sp., could have been ingested by animals through drinking water in open sources.

In addition to habitat, fruiting time is another ecological variable to be considered: it is expected that the weed assemblage originating from by-products of agricultural crops processing is composed by taxa that reach maturation during or shortly before the harvest – June and July in Anatolian cereal farming (e.g., Hillman 1984, Hoffner 1974). On the contrary, in case of dung-burning residues, the fruiting time of the recorded taxa could vary (e.g., Charles 1998: 114-115). In the specific case here discussed, the contribution of this approach is limited by the extended fruiting time of several common forage taxa recorded in the sequence, which overlaps with the harvest season (Filipović 2014: 90-91).

In the context of this dissertation, the last two criteria outlined by Charles (1998) have not been fully investigated: (*i*) the behavior of non-crop seeds in relation to crop processing could not be applied due to limited data accessibility (Jones 1983, unpublished PhD dissertation), and missing information on the physical properties (Aerodynamics, 'headedness', size; see Jones 1987 and Filipović 2014: 78-85) of several non-crop taxa identified in the carpological flora from Kınık Höyük; (ii) the presence of mixtures of crops (grain and chaff) not expected to be grown and/or processed together is a further criterion that cannot be applied to the record from Kınık Höyük, due to a cereal assemblage largely dominated by free-threshing wheat and hulled barley, two crops that are known to have been processed (and even cultivated) together (e.g., Halstead and Jones 1989, Jones and Halstead 1995).

To conclude this section, I consider it highly likely that ruminant dung burning represented one of the main taphonomic pathways leading to the formation of the archaeobotanical assemblage from Niğde-Kınık Höyük. This hypothesis will be tested by future geoarchaeological research (e.g., Smith et al. 2019), which is not included in the dissertation project. If we consider the ratio between wild/weed taxa-to-wood charcoal as a proxy for the intensity of dung use, the trend clearly indicates a progressive increase in the use of dung as fuel, reaching a peak in the second half of the 1st millennium BCE (Figure 6.38). This hypothesized intensification in dung-burning took place, thus, during a phase of expansion of the local agricultural landscape (Section 6.4.1), of an intensification of the use of pruning residues as firewood resource (Section 5.4.4), and a possible clearance of the riparian vegetation (Section 5.4.1). It might be, accordingly, tempting to suggest that it was a phase of deforestation and agricultural expansion, it corresponds to an increased exploitation of agricultural by-products as fuel resources, which included pruning residues (Section 5.4.4) and – as discussed in this section – likely also ruminant dung.

6.4.3 C*ontextual analysis of materials from the Achaemenid and Hellenistic occupation*

As already pointed out at the beginning of Section 6.4, in addition to chronology, the spatial and contextual provenience of the samples represents a second factor underlying the detected variability in the dataset. In the following paragraphs, I will discuss this latter aspect of the record, focusing on the evidence available from period KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE). These two occupation periods have been selected for this type of analysis considering their satisfactorily sampling coverage, with respectively 56 and 39 samples originating from four different excavation areas: Trench A1 and Trench A2 in the northern sector of the citadel, Operation B on the hilltop, and Operation D in the lower town (Figure 6.39, Section 3.4.3).

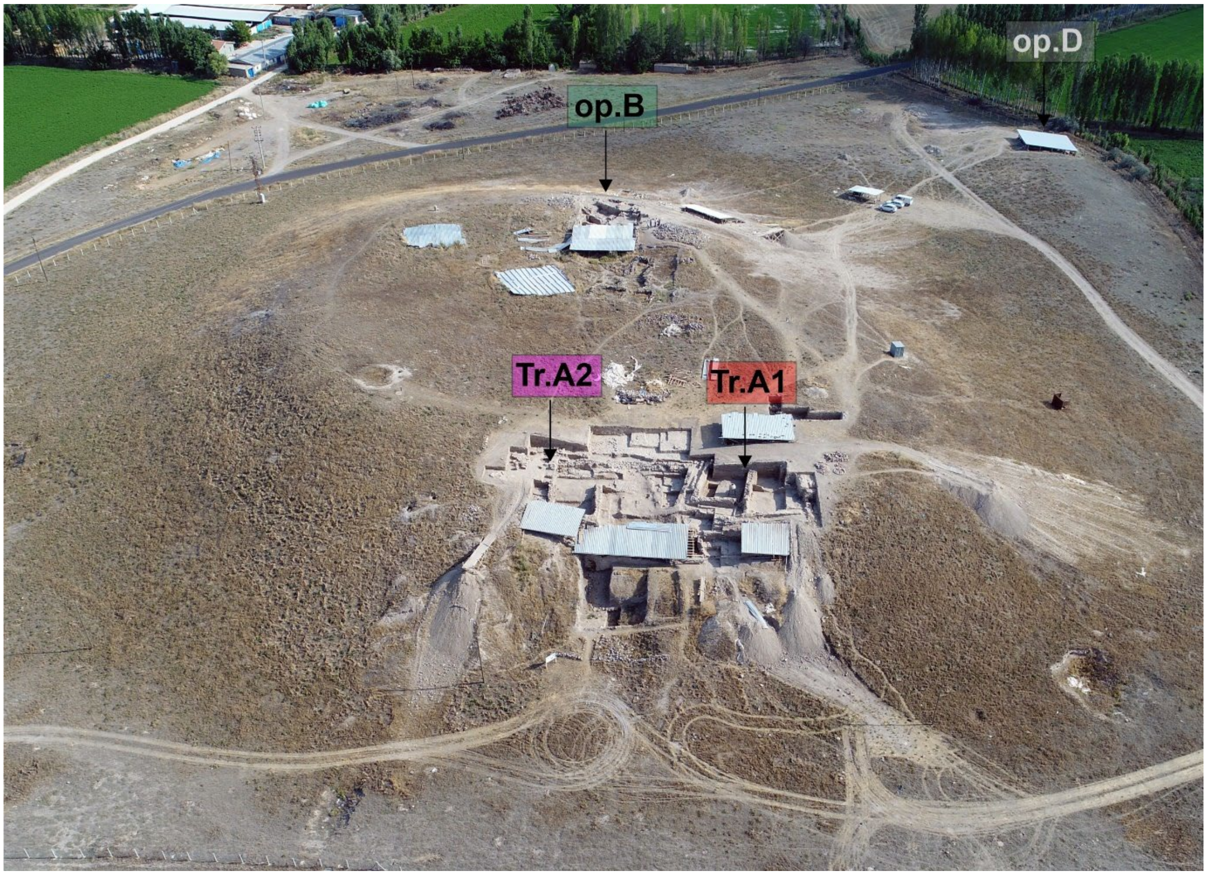


Figure 6.39 – Drone view of the site of the mound of Niğde-Kınık Höyük, from north to south. Operations B and D and Trenches A1 and A2 are located.

Multivariate analysis can provide a good exploratory starting point for our considerations, as already done for the general interpretation of the assemblage (Figure 6.30 and Figure 6.31). In the Correspondence Analysis (CA) of the crop dataset presented in Figure 6.40 are included samples dated to period KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE), reporting for each sample both chronology and spatial origin. In order to facilitate the reading of the figure, pie charts indicate for each sample the proportion of cereal grains, cereal rachis, pulses, and fruits and nuts (Figure 6.40).

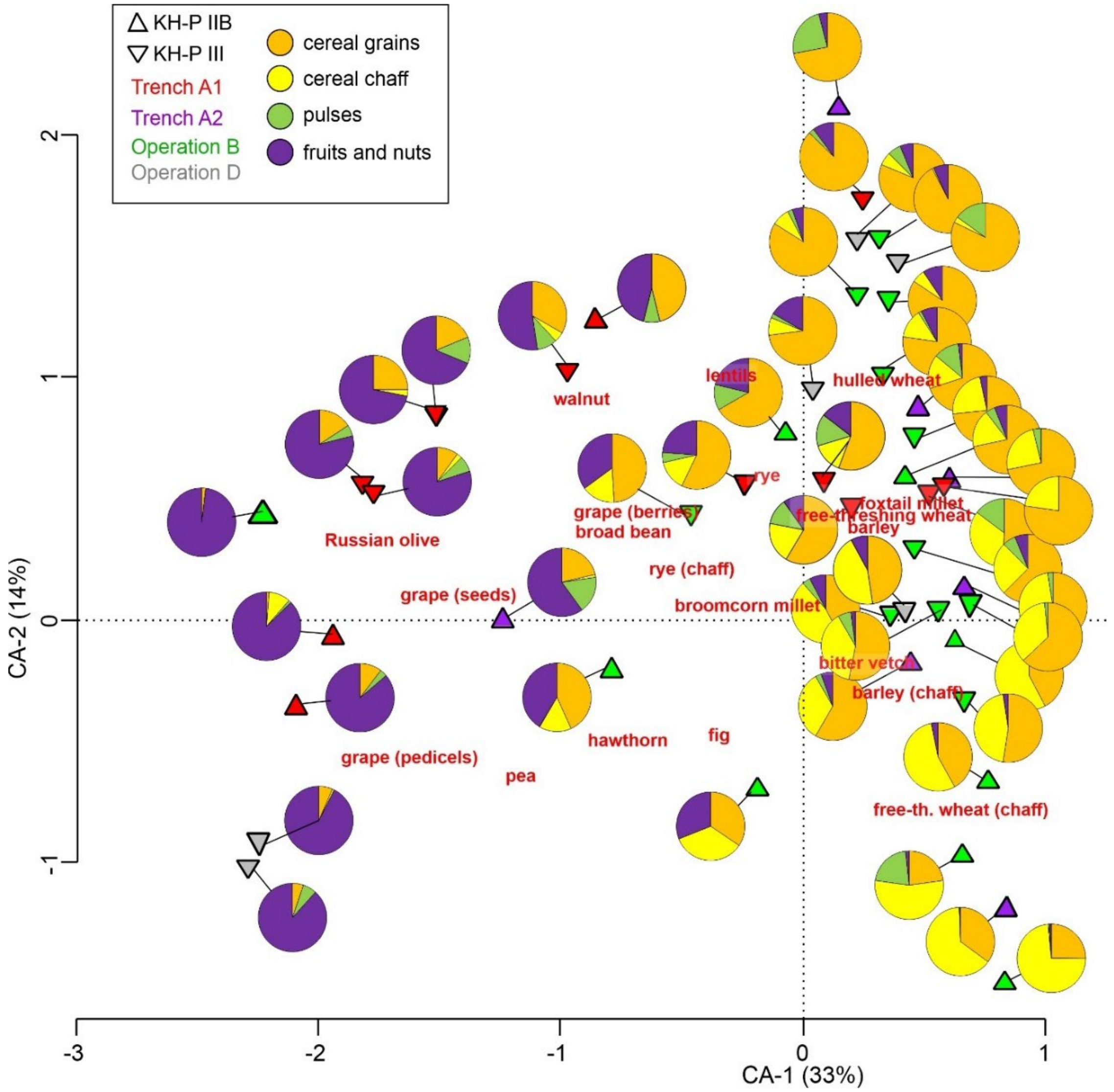


Figure 6.40 – *Correspondence Analysis (CA), economic taxa from samples attributed to Period KH-P IIB (200-1 BCE) and KH-P III (500-200 BCE). Computation is based on concentration values. For methods see* Section 6.2.4*. Symbols indicate the occupation period, while colors the trench/operation.*

The first Axis of the CA (accounting for the 33% of the variance) can be interpreted as explaining the contribution of cereals (associated to positive values in the axis) and fruits/nuts (negative values). The second CA axis (14% of the variance) appears to indicate the contribution of the different crop parts, with negative values in the axis associated to either chaff remains or grape pedicels. Figure 6.40 clearly indicates that fruit and nut taxa (*Vitis vinifera*, *Elaeagnus angustifolia*, and *Juglans regia*) are associate predominantly with samples from Trench A1. On the contrary, coeval samples from other areas of the site (Operation B, Operation D, Trench A2; see Figure 6.39) are associated to a higher contribution of cereals, with a variable attestation of grains and chaff. These differences between Trench A1 and other coeval areas of the site will be discussed in the following paragraphs.

– *A bioarcheological signature of Cultic activities? The carpological evidence from the NW Building* (*Trench A1, KH-P III – 500-200 BCE*)

In Figure 6.41, I have reported sample-by-sample relative abundances of economic taxa from period KH-P III (500-200 BCE). Based on stratigraphy, samples from Trench A1 are attributed to Levels A1.3 and A1.2, the latter divided into two phases: A1.2a and A1.2b. Level A1.3 is dated to the Achaemenid period (6th – 4th century BCE), while Level A1.2 is dated to the Late Achaemenid/Early Hellenistic occupation (4th to mid-2nd century BCE) (Trameri and d'Alfonso 2020: 68). Based on the evidence presented in Figure 6.41, it is possible to recognize the presence of several distinct trends defining the archaeobotanical assemblage from Trench A1, Phase A1.2a: (*i*) the samples are characterized by very high concentrations of wood charcoal, which are paralleled by low concentrations of carpological remains – the only exceptions are samples KIN16A1745s95 and KIN13A175s117, originating from two units which have been already recognized during excavation as distinct from the rest of the deposit (single dumps of ash-rich deposits; Andrea Trameri, *pers. com.*); (*ii*) the crop assemblage is dominated by fruits and nuts, with grape (*Vitis vinifera*) representing the most common taxa. It is, furthermore, recorded an atypical ubiquitous presence of Russian olive (*Elaeagnus angustifolia*) and walnut (*Juglans regia*) – two taxa that are otherwise unattested at the site during Period KH-P III, which presence in these deposits is to be emphasized considering the low concentrations of carpological remains; and finally (*iii*) cereal chaff is found only sporadically. Based on these unique aspects, the record from Trench A1, Phase A1.2a, is significantly distinct from assemblages originating from earlier levels/phases in the same trench (A1.2a and A1.3) and from other areas of the site (Operations B and D). KH-P III samples from Operation B are dominated by cereal grains and chaff, grape seeds are found ubiquitously yet in low relative abundances, Russian olive and walnut are not attested, wood charcoal is present in low concentrations, while very high concentrations of wild/weed taxa are recorded. Similar archaeobotanical assemblages, although with a higher degree of sample specific variability, are documented in contemporaneous levels from Operation D (Figure 6.41).

In addition to carpological evidence, samples from Trench A1, Phase A1.2a, are further characterized by a distinctive wood charcoal assemblage: (*i*) despite the higher number of specimens, a low floristic diversity is found; (*ii*) across samples, a standardized anthracological composition is detected – oak (*Quercus* spp. deciduous) is the most abundant taxon, which is followed by grapevine (*Vitis vinifera*), apple/pear type (Maloideae), and few yet ubiquitous charcoal of plums (*Prunus*-Type), and Russian olive (*Elaeagnus angustifolia*) – the latter a taxon that is not attested elsewhere during KH-P III. Samples KIN16A1745s95 and KIN13A175s117 are, also in these regards, outliers (Figure 6.42).

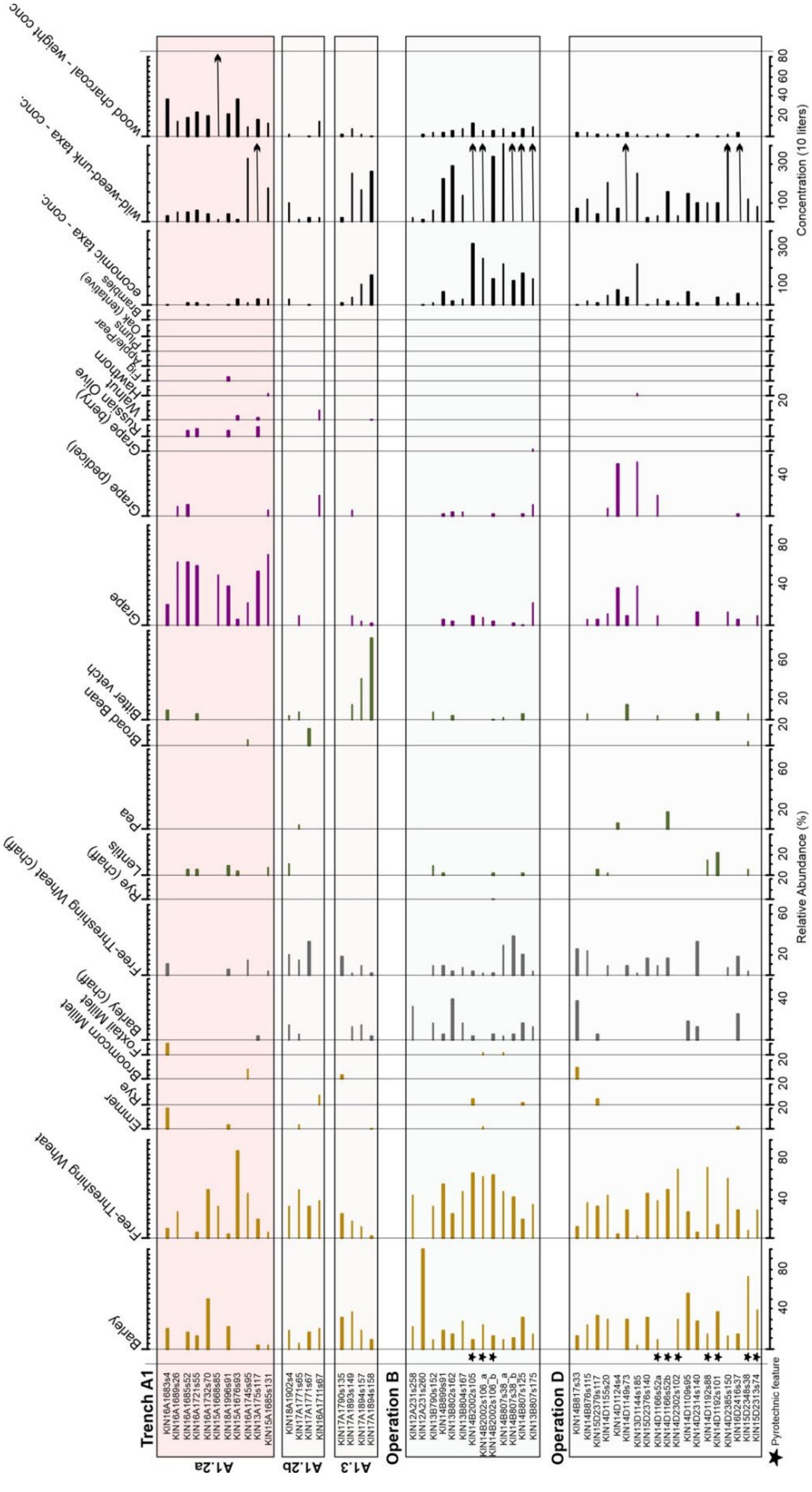


Figure 6.41 – *KH-P III (500-200 BCE), relative abundance of economic taxa, calculated using as sum the total of economic plant parts.*

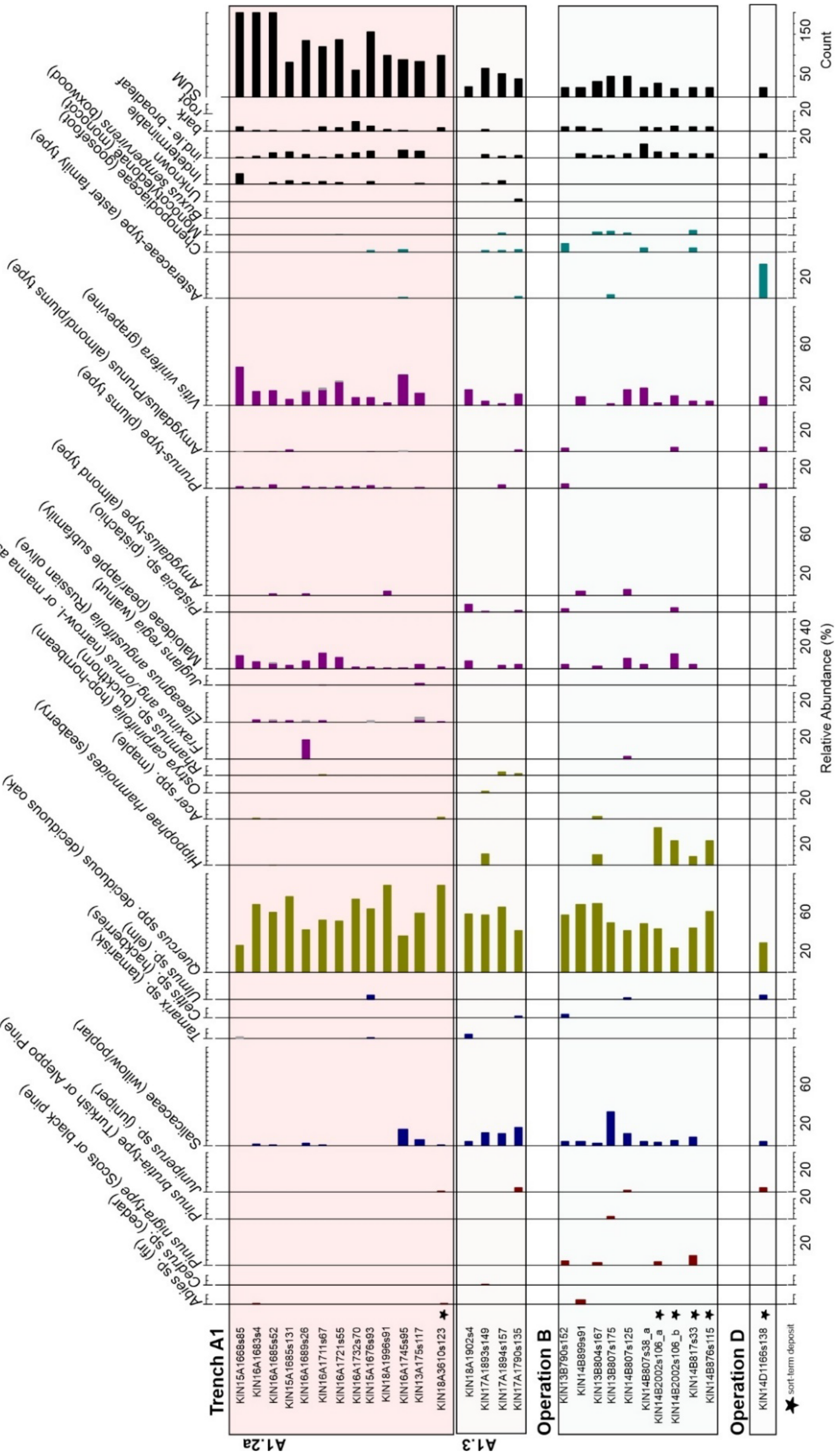


Figure 6.42 – *KH-P III (500-200 BCE), sample-by-sample relative abundance of wood charcoal. Only samples with more than 20 charcoal fragments analyzed are reported*

Trench A1 is located on the northwestern edge of the mound (Figure 6.39). At the earliest during the 4th century BCE, on top of preexisting architecture (Level A1.3), a new complex was constructed, which is referred to in the excavation documentation and literature as the 'NW-Building' (Level A1.2) (Trameri and d'Alfonso 2010, d'Alfonso et al. 2020). To this building are attributed four contiguous rooms (Ar2, Ar3, Ar4, and Ar5), which represent a portion of a larger building complex – which norther limits, on the mound slopes, very likely have been fully eroded (Figure 6.43).

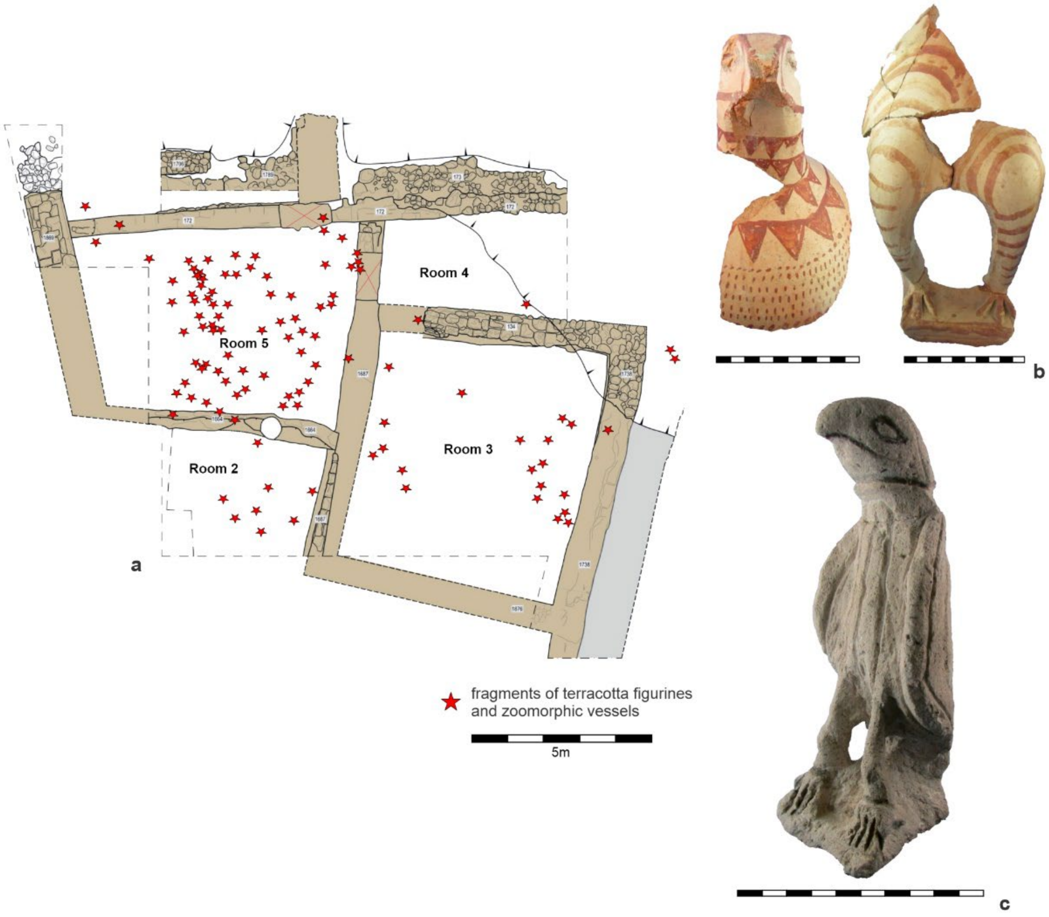

Room 4
Room 5
Room 3
Room 2
a
fragments of terracotta figurines and zoomorphic vessels
5m
b
c

Figure 6.43 – *KH-P III (500-200 BCE) building in Operation A, Trench A1, and examples of a zoomorphic vessel (b) and figurine (c) found in the NW building, Level A1.2 (after Trameri and d'Alfonso 2020).*

Based on both dimension and spatial organization, we can exclude a domestic function of the NW-Building. Room Ar5 possibly represented an open court, Room Ar4 could have been a hallway, and Room Ar3 could have functioned as storeroom (Trameri and d'Alfonso 2020). At a later stage (Phase A1.2a), the doorways opening on Room Ar5 were sealed, and the room was progressively filled with accumulations: these deposits are 5 to 10 cm thick, and extremely rich in bones, ashes, burnt material, and tableware ceramic. This sequence of accumulations forms a roughly 1.5 m thick, comparatively homogenous, deposit. The samples discussed in the previous paragraphs and highlighted in Figure 6.41 (carpology) and Figure 6.42 (anthracology) were collected from these accumulations, which filled Room Ar5 during phase A1.2a.

A distinctive aspect of Level A1.2, and in particular of Room Ar5 during Phase A1.2a, is the ubiquitous and comparatively abundant presence of terracotta figurines in shape of humped cattle, small stone statues of birds of prey, and zoomorphic bird-shaped vessels (Figure 6.43) (Trameri and d'Alfonso 2020). A further peculiarity of the deposit filling room Ar5 during phase A1.2a is the abundant presence of animal bones, with a faunal assemblage unique in comparison to other deposits originating from elsewhere at the site or from other levels/phases in Trench A1 (Crabtree et al. 2018). The lack of diversity is striking: 94% (based on NISP) of the domesticates are attributed to sheep/goat (Caprinae), only 6% of cattle (*Bos taurus*) is recorded, and no pig bones (*Sus scrofa*) are documented. In addition to taxonomic composition, also the age profile of these materials appears atypical, lacking both very young (< 6 months of age) and very old (>2 years old) sheep and goat individuals. The zooarchaeological assemblage is further characterized by a rich presence of meat-rich body parts – such as vertebrae, ribs, and upper limbs. A radically different zooarchaeological record is attested in deposits from layers in

Operation D that date to the same period, in the lower town, which are characterized by a higher number of cattle, pigs, equids, and wild fauna (e.g., red deer, hare, and fox). In these latter contexts, based on NISP, sheep/goat accounts for the 77% of the domesticated assemblage. The zooarchaeological record from Period KH-P III in Operation D is more consistent with the assemblages found elsewhere at the site throughout the 1st millennium occupation (Crabtree and Campana 2016, Crabtree et al. 2018, Castellano et al. forthcoming).

Based on the considerations made in the previous paragraphs, I suggest that it is possible to reconstruct the presence of a specific depositional pattern underlying the filling of Room Ar5 in the NW-Building (Level A1.2, Phase A1.2a). As discussed elsewhere (Trameri and d'Alfonso 2020, d'Alfonso et al. 2020), this building complex is likely to represent (or be associated with) a sanctuary. The deposits discussed in this section, filling room Ar5 during phase A1.2a, could be accordingly tentatively connected to ritual behaviors. Zooarchaeological evidence suggests the presence of activities that were connected to sacrifice, feasting, and/or communal meals – which targeted meaty body parts of sheep/goat of a specific age. The distinctive composition of the archaeobotanical assemblage, including both seed/fruit remains and wood charcoal, might suggest that also plant resources played a role in these ritual activities. Perhaps, fruits and nuts (grape, Russian olive, and walnut) could have been part of the offerings/meals. Furthermore, the pyrotechnological activities occurring as part of this hypothesized ritual/cultic practices were conducted using selected firewood, rather than dung as was very likely a common case elsewhere at the site (Section 6.4.2). It is, thus, hypothesized that the specific composition of these samples could be associated with a selection of plant materials motivated by ritual behavior.

– A wine storing area? The carpological evidence from the storage terrace in Trench A1 (KH-P IIB; 200-1 BCE)

For reasons currently still unclear, around the mid-2nd century BCE, a new architectural complex (Level A1.1) was built on top of the NW Building (Level A1.2). This new occupation level is attributed to period KH-P IIB (200-1 BCE). Finds from this latter period indicate that the site was at that time directly and actively engage in the Hellenistic koine (Section 3.3.4), as indicated by ceramic typology, coins, terracotta figurines, and Greek inscriptions (Trameri and d'Alfonso 2020: 74).

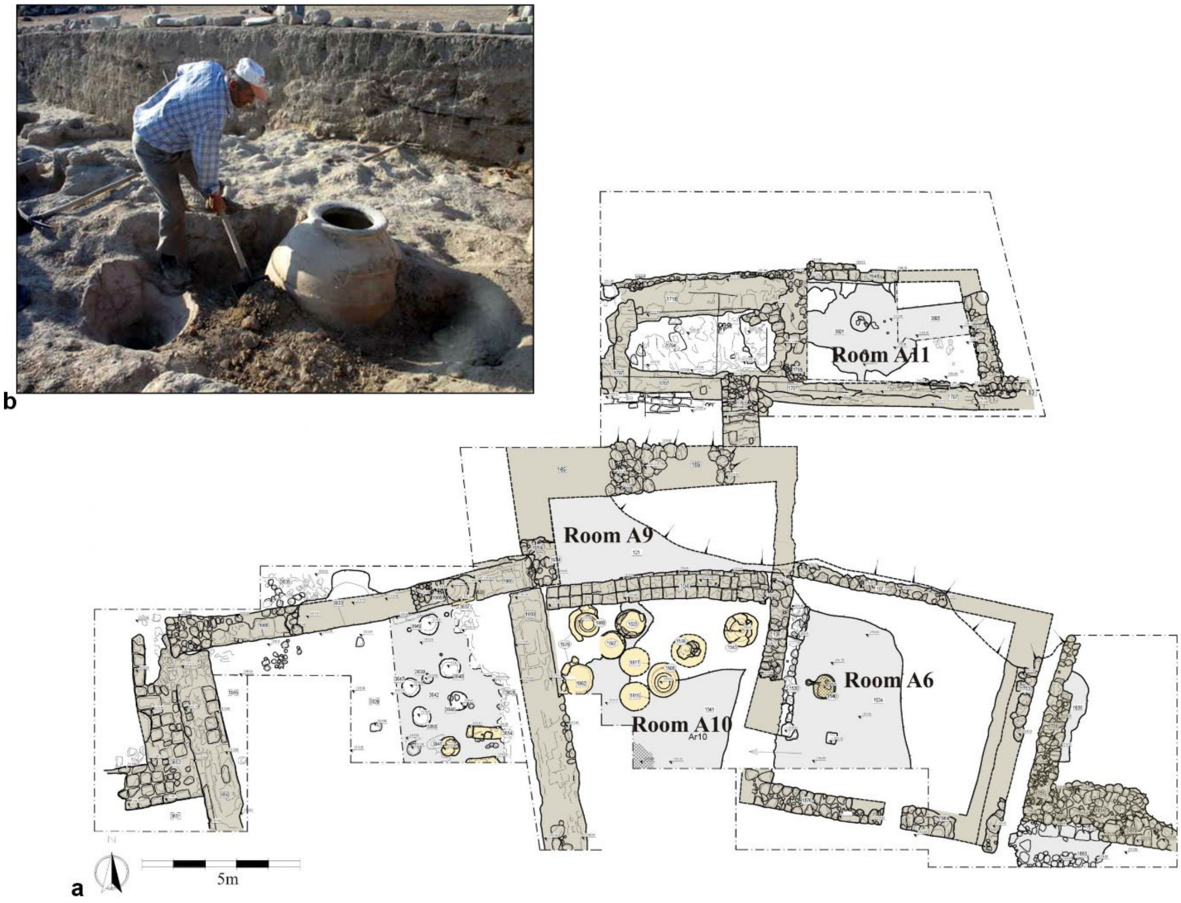
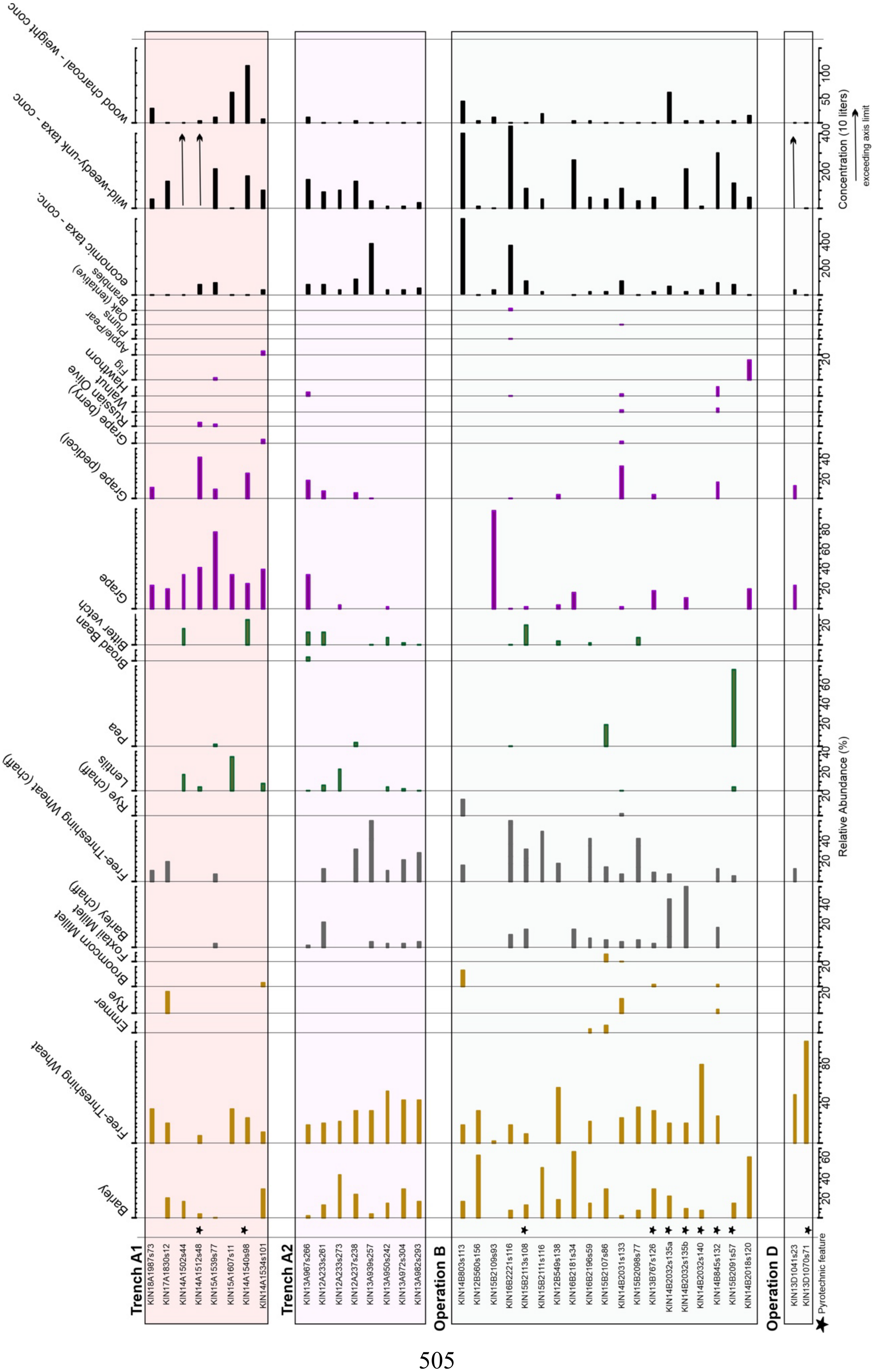


Figure 6.44 – *KH-P IIB (200-1 BCE) terrace building in Operation A, Trench A1. In panel b one of the pithoi present in the area under excavation.*

A large terrace was built (Phase A1.1e) on top of the former Levels A1.2 rooms Ar2 and Ar5. During the following phases, the terrace was further expanded, ultimately occupying the entire area

(Phases A1.1d-a). The main function of the exposed portion of this building complex appears to have been connected to storage, as indicated by the presence of several pithoi installations (Figure 6.44). Considering both the number and the volume of the storage vessels, these activities appear to have occurred at a scale far exceeding the domestic ambit. The repertoire of finds associated to this context remains in large part distinctive and unique, including a rich collection of bronze coins, several metal objects (such as furniture appliques, a bronze serving ladle, a bronze dagger, knives, spreadheads, javelin heads, metal vessels, and a pair of silver alloy leonine paws), fragments of wall-painting, terracotta female figurines, and a collection of astragali (knuckle bones) (Trameri and d'Alfonso 2020: 75-76). The atypical concentration of these finds suggests that in association to storage this area of the site maintained a cultic destination also during period KH-P IIB (200-1 BCE), perhaps functioning as a storeroom of a sanctuary (Trameri and d'Alfonso 2020, d'Alfonso et al. 2020).

In Figure 6.45 it is summarized the carpological evidence of economic taxa from period KH-P IIB (200-1 BCE). If compared to coeval samples from other areas of the site, the assemblage from Trench A1 remains distinctive, characterized by lower amounts of cereals, with chaff particularly rare, and a ubiquitous presence of grape seeds and pedicels. The presence of low amounts of cereals is somehow unexpected in a grain storage area. Lacking a destruction layer, the pithoi from this context have been found empty. It would be, however, expected in a grain storage context to register a more abundant presence of cereal remains: the cleaning and burning of storage residues in pithoi is a crucial step in order to minimize grain spoilage, limiting the building-up of pests and molds in the debris accumulating at the bottom of these large containers (van der Veen 2007). On the contrary, the record from Level A1.1 stands out for a dominance of grape seeds and pedicels rather than cereals (Figure 6.45).


Barley
Free-Threshing Wheat
Emmer
Rye
Broomcorn Millet
Foxtail Millet
Barley (chaff)
Free-Threshing Wheat (chaff)
Rye (chaff)
Lentils
Pea
Broad Bean
Bitter vetch
Grape
Grape (pedicel)
Grape (berry)
Russian Olive
Walnut
Hawthorn
Fig
Apple/Pear
Plums
Oak
Brambles (tentative)
economic taxa - conc.
wild-weedy-unk taxa - conc
wood charcoal - weight conc
Trench A1
KIN18A1987s73
KIN17A1830s12
KIN14A1502s44
KIN14A1512s48
KIN15A1539s77
KIN15A1607s11
KIN14A1540s98
KIN14A1534s101
Trench A2
KIN13A967s266
KIN12A233s261
KIN12A233s273
KIN12A237s238
KIN13A939s257
KIN13A950s242
KIN13A972s304
KIN13A982s293
Operation B
KIN14B803s113
KIN12B560s156
KIN15B2109s93
KIN16B2221s116
KIN15B2113s108
KIN15B2111s116
KIN12B549s138
KIN16B2181s34
KIN16B2196s59
KIN15B2107s86
KIN14B2031s133
KIN15B2098s77
KIN13B767s126
KIN14B2032s135a
KIN14B2032s135b
KIN14B2032s140
KIN14B845s132
KIN15B2091s57
KIN14B2018s120
Operation D
KIN13D1041s23
KIN13D1070s71
★ Pyrotechnic feature
20 40 60
20 40 60 80
20
20
20
20 40
20 40
20 40
20 40 60
20
20 40 60 80
20 40
20
Relative Abundance (%)
200 400
200 400
50 100
Concentration (10 liters)
exceeding axis limit

(Previous page) Figure 6.45 – *KH-P IIB (200-1 BCE), sample-by-sample relative abundance of economic taxa, calculated using as sum the total of economic plant parts identified. Economic taxa, wild and weedy taxa, and wood charcoal (>2mm) concentrations (10-liter) are reported.*

Based on these considerations, it is tempting to speculatively identify wine rather than cereal grains as the main product stored in these pithoi. A variable amount of grape pressing residues accumulates at the bottom of wine storage containers, which cleaning can lead to archaeobotanical assemblages containing a mixture of grape seeds and pedicels (Margaritis and Jones 2006). This working hypothesis would furthermore explain the presence in this context of valuable metal drinking vessels (e.g., a possible leonine cista) and wine serving tools (e.g., a bronze ladle) (see Trameri and d'Alfonso 2000: 75). It could be, accordingly, tentatively hypothesized that within the sanctuary, these storerooms represented wine storage areas. Ongoing chemical residue analysis will allow to further corroborate this hypothesis.

6.4.4 *Viticulture in southern Cappadocia: the archaeobotanical evidence from Niğde-Kınık Höyük*

In the discussion provided in the previous sections (Section 6.4.1 and 6.4.3), viticulture clearly emerges as a hallmark of the 1st millennium BCE agricultural landscape orbiting around the site of Niğde-Kınık Höyük. In the archaeobotanical record from the site, grape remains are attested in form of wood charcoal (Table 5.3), grape seeds, and grape pedicels (Table 6.5-12). Furthermore, single fragments of pressed skin, entire berries, and tendrils are documented (Appendix 7). In order to summarizes the quantitative trend of the *Vitis vinifera* macro-botanical remains, Figure 6.46 provides the concentrations values of grapevine charcoal, grape seeds, and grape pedicels.

The resulting picture is extremely coherent across the three main types of *Vitis* macro-remains found in the sequence. As already noted, *Vitis* remains are first attested during period KH-P VA (1000-800 BCE), they increase during period KH-P IV (800-500 BCE), for then peaking in period KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE). Only two samples are available from period KH-P IIA (1-300 CE), it is however noteworthy the presence during this poorly sampled phase of a large concentrations of grape seeds (Table 6.6). After the occupation hiatus, *Vitis* remains are still attested during KH-P I (1200-1450 CE) (Figure 6.46). It should be noted that charcoal and seeds/pedicels are deposited following different taphonomic pathways, thus further strengthen (if needed) the direct interpretation of this evidence in terms of progressive increase in importance of viticulture in the agricultural landscape surrounding Niğde-Kınık Höyük – an activity which reached a remarkable economic centrality starting, at least, with the mid-1st millennium BCE.

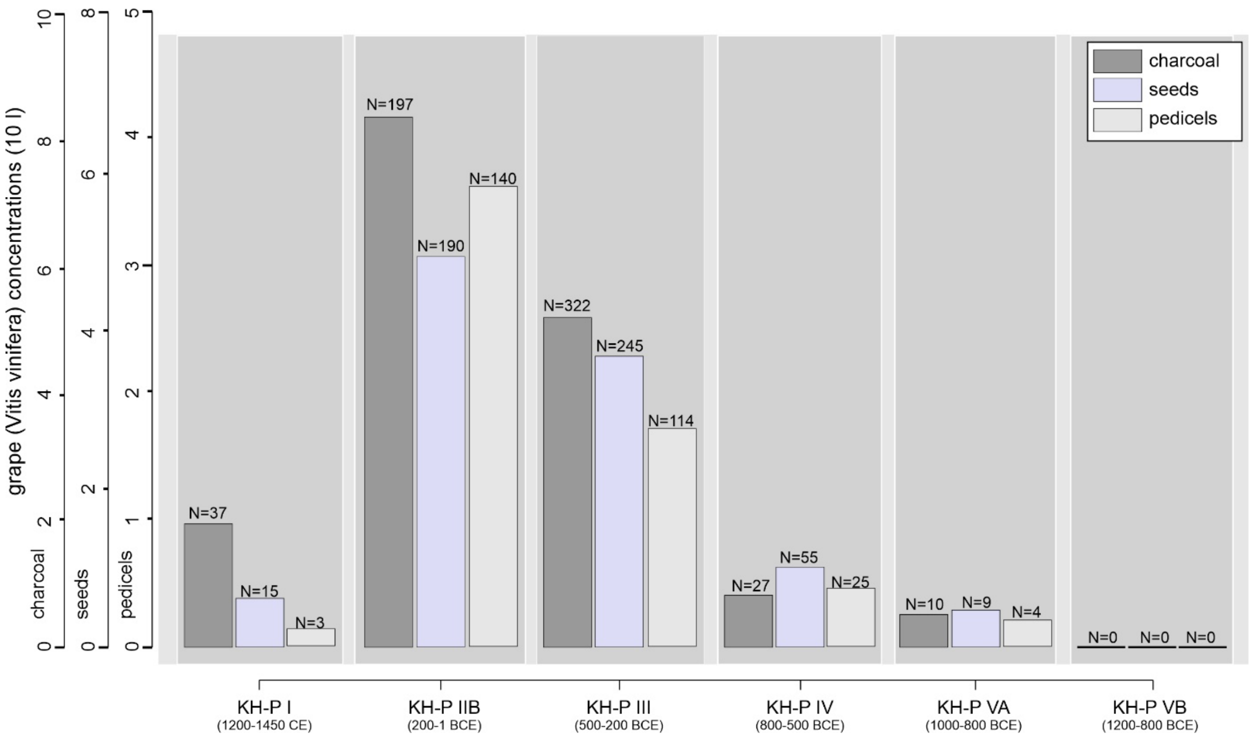


Figure 6.46 – *concentrations (items/10 l sample) calculated for grapevine charcoal, grape seeds, and grape pedicels. Number of items are reported on top of the graph.*

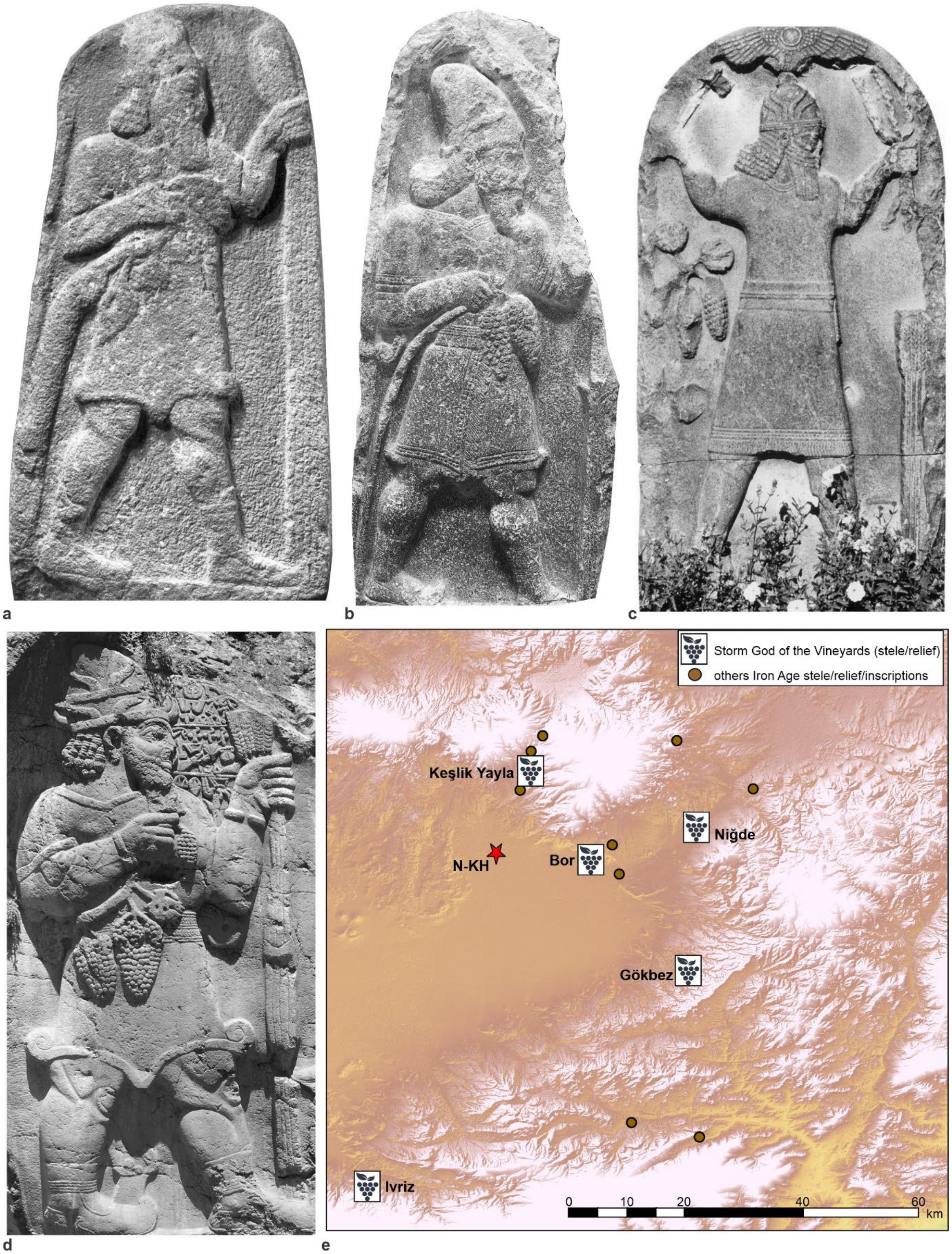

a
b
c
d
e
Storm God of the Vineyards (stele/relief)
others Iron Age stele/relief/inscriptions
Keşlik Yayla
Niğde
N-KH
Bor
Gökbez
Ivriz
0
10
20
40
60
km

Figure 6.47 – *iconographic representations of the Storm God* (Tarhuntas) *of the vineyards and location of a map:* (*a*), Keşlik Yayla; (b), Bor; (c), Niğde; (d), Ivriz. Images from www.hittitemonuments.com.

As discussed in Section 5.4.3, the local importance of viticulture is matched by textual and iconographic evidence. The local cult of the Storm-God of the vineyard, which is centered in the kingdom of Tuwana in the Bor-Ereğli plain (Section 3.3.2), corroborates both the antiquity and cultural-symbolic centrality of this tradition. As already discussed elsewhere in the dissertation (Section 3.3.2, Section 5.4.3, Section 6.4.1), iconographic and epigraphic evidence of this cult is found throughout southern Cappadocia (Figure 6.47) and is dated to the late 8th/early 7th century BCE, thus matching a first phase of increase in the *Vitis* record at Kınık Höyük (KH-P IV, 800-500 BCE) (Figure 6.46).

Fragmentary epigraphic data and numismatic sources (Berges and Nolle 2000: 312-313) suggest that viticulture retained an important regional role in southern Cappadocia during the Hellenistic and Roman periods. Further later in time, wine-press installations are found in rock-cut settlements throughout Cappadocia (Peker 2020), which supports documental sources (e.g., Haldon 1990: 103) in pointing to the presence of a rich wine-making economy in Byzantine Cappadocia. A wine press is reported also from the rock-cut settlement of Bayatönü, a few kilometers away from Kınık Höyük, near the town of Anthunisar (Peker 2020). Viticulture retained a central economic and cultural importance also following the incorporation of Cappadocia under the Seljuk and Ottoman Empires – in line with the archaeobotanical evidence from the Kınık Höyük (Figure 6.46). During the Ottoman period, archival tax documents indicate the presence of large and economically remunerative vineyards around the city of Bor (Balta 2017), ca. 15 km east of Kınık Höyük. Vineyards are still to date a ubiquitous and remunerative central component of the local agricultural landscape and rural economy (Figure 6.48), as discussed in Section 3.4.2.

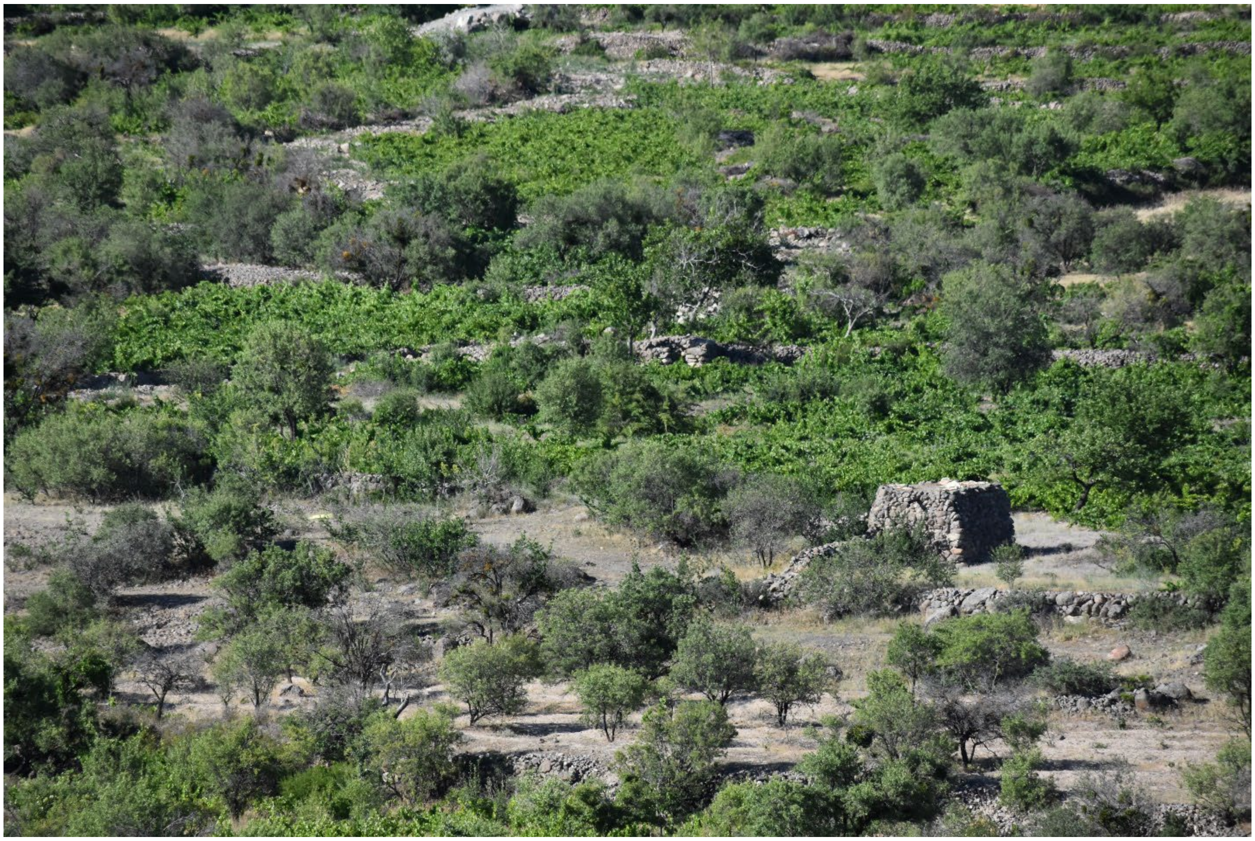


Figure 6.48 – *Gardens in proximity of the village of Yeşilyurt, 2 km to the north of the site of Niğde-Kınık Höyük. To be noted the presence of grapevine, growing as self-standing bushes interspersed with almond trees and other arboreal crops.*

–Depositional pathways of grape macro-remains

Having documented the importance of viticulture in the agricultural landscape of southern Cappadocia, a question that remains to be answered concerns the specific activities that drove the establishment and progressive expansion of viticulture in this region. In other words, for which purposes were these vineyards cultivated? Grapes can be used to produce a number of products. The fruits can be consumed fresh or dried into raisin, the latter providing a sugary product which can be consumed all year round. The fruits can be processed into fresh juice or fermented derivates (e.g., wine and vinegars). Grape juice can be, furthermore, reduced by simmering into syrup – a product known in

Turkey as *pekmez*. In traditional agricultural economies these different modalities of consumption are largely expected to coexist, reflecting the plurality of uses of grapes (e.g., Margaritis and Jones 2006), and more in general a tendency towards diversification in production and consumption patterns. We can thus reasonably assume that the grape macro-remains found across an archaeological site reflect different modalities of consumptions of grapes and grape-products.

Experimental and ethnographic literature (e.g., Margaritis and Jones 2006, Valamoti et al 2007) allows me to tentatively correlate specific grape macro-remains assemblages to different consumption patterns and/or steps in the transformation of grape-products. The work conducted by Margaritis and Jones (2006) represents a seminal contribution in these regards. According to the ethnographic and experimental study conducted by the authors, they argue that: (*i*) the presence of small quantities of loose grape seeds found throughout a site can be interpreted as by-product of the consumption of fresh berries or raisins; (*ii*) the presence of numerous seeds, large peduncles, rachis, and pedicels, found together with pressed skins, is regarded as indicative of the occurrence of by-products of wine pressing; (*iii*) numerous grape seeds associated with moderate amounts of grape pedicels and pressed skins can be interpreted as originating from wine dregs or other post-pressing residues.

In the record from Niğde-Kınık Höyük, grape macro-remains (seeds and pedicels) are found in 109 samples (63% of the samples analyzed), in 41 of these samples, grape seeds and pedicels co-occur (Figure 6.49-a). The ubiquitous presence of grape remains, in the form of both seeds and pedicels, across the site suggests that grape-processing activities represented an important aspect in the local economy (e.g., White and Miller 2018). Based on the model outlined by Margaritis and Jones (2006), the presence of samples with numerous seeds associate to pedicels (Figure 6.49-b) is in line a possible identification of by-products of wine-making activities. It remains to be explained, however, the paucity of grape skins in the assemblage, which are found only in a single sample (KIN17C665s63). We could tentatively attribute the lack of this latter type of remains to taphonomic processes (as discussed below) and perhaps also by the impact of flotation in the preservation of these delicate remains.

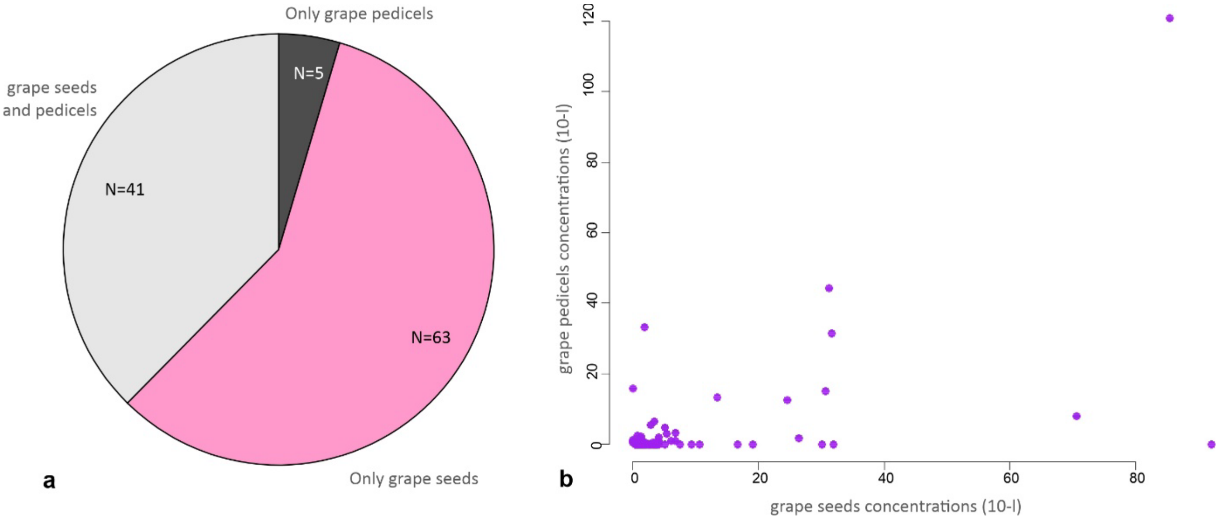


Figure 6.49 – *grape (Vitis vinifera) seeds and pedicels in the Niğde-Kınık Höyük sequence: a, pie chart showing the samples containing seeds and pedicels, only seeds, only pedicels; b, correlogram between seed and pedicel concentrations, each dot represents a sample.*

To date, at Niğde-Kınık Höyük we lack samples directly associated to grape-processing structures, which complicates taphonomic interpretation of the carpological *Vitis* evidence. As noted by White and Miller (2018: 211), grape macro-remains originating from pomace, wine dregs, and other processing residues could have entered the archaeological record either by direct burning or via ruminant dung used as fuel. The use of grape processing by-products as animal forage is a well-known practice, which is still practiced to date (Jurácek et al. 2021, Rolinec et al 2021). The hypothesis of the incorporation of grape macro-remains in the record via ruminant dung burning – although consistent with the general interpretation of the archaeobotanical assemblage from the site (Section 6.4.2) – to date remains, however, speculative. More straightforward, on the other hand, is the interpretation of the abundant evidence of grapevine charcoal, which as discussed in Section 5.4.4 could very reasonably originate from a systematic exploitation of vineyards pruning residues as fuel.

– *Are grape seeds just grape seeds? Morphometric analysis of the* Vitis vinifera *carpological record*

The presence of a large collection of *Vitis vinifera* seeds allowed me to conduct morphometric analysis of these remains – a field of research which has been overlocked in Anatolian, and more in general across western Asian, archaeobotany (White and Miller 2018).

The morphometric analysis of grape seeds has a long history of research in archaeobotany. An interest in this topic originated in the early 20th century (Stummer 1911), driven by attempts to distinguish based on seed anatomy wild (*Vitis vinifera* ssp. *sylvestris*) and domesticated (*Vitis vinifera* ssp. *vinifera*) grapevine populations. Over the last two decades, the topic has received renewed attention, promoting a new wave of research focused on the broader issue of ancient biodiversity in *Vitis vinifera* cultivars and varieties (e.g., Bonhomme et al. 2021, and therein references). In this section, I will first summarize the main approaches present in the literature, for then applying linear measurements-based methods to the *Vitis vinifera* carpological assemblage from Kınık Höyük. Seed-by-seed measurements are provided in Appendix 8.

Wild and domesticated grapevines have distinctive and defining sexual-related flower anatomy: wild populations are widely dioicous, with different individuals bearing respectively carpellate and staminate flowers; on the contrary, domesticated grapevines are hermaphrodite, bearing perfect flowers (Zohary et al. 2000: 121-124). Although seed morphology is doubtfully a trait directly selected in the grapevine domestication process, the presence of diagnostic wild and domesticated seed morphotypes has been suggested: wild grapevines tends to have small and roundish seeds with short stalks, while domesticated grapevines generally produce seeds that are more elongated and have longer stalks (Levadoux 1956). The botanist Albert Stummer was the first scholar to attempt to distinguish wild and domesticated grapevine populations based of seed morphology (Stummer 1911). He analyzed specimens originating from modern and wild populations in the region of Vienna, proposing to distinguish seeds belonging to wild and domesticated individuals based on a breadth-to-length ratio ("Stummer Index"; B/L*100). According to Stummer (1911), grape seeds with an index lower than 54 are indicative of the presence of domestic individuals, seeds with values above 75 of wild, while specimens having an index comprised between 54 and 75 could not be attributed (Stummer 1911).

The Stummer Index was subsequently applied to archaeological remains (e.g., Schiemann 1953, Stockmans 1957). It was, however, noted (e.g., Logothetis 1970 and 1974) that the ratio between breadth and length in charred grape seeds is strongly impacted by the carbonization process: experimental evidence clearly indicates that the charring process affect unevenly the length and breadth of grape seeds, resulting in charred seeds being smaller and more rounded in shape after carbonization (Smith and Jones 1990). It should be, furthermore, noted that the Stummer Index threshold values were based on observations conducted on a limited dataset, which can be hardly considered representative of the morphometric variability across and within domesticated and wild grapevine populations.

Having recognized the intrinsic limitations in the use of the Stummer Index to classify wild and domesticated populations, Mangafa and Kotsakis (1996) developed a new method based on a large collection of charred modern specimens from different wild and domesticated populations. The methodology proposed by these two authors is based on three reference measurements: the total length of the seed, the length of the stalk, and the distance between the proximal end of the stalk and the chalaza. The three values are used in four different formulae, on which basis a grape seed could be attributed as originating from wild, likely wild, domesticated, or likely domesticated individuals (Mangafa and Kotsakis 1996). A further linear measurement method was proposed by Perret (1997) based on the ratio between stalk and total seed length (LS/L*100). According to the author, domesticated grape seeds have an index usually above 19, while in seeds from wild populations the same index is generally below 19. On a qualitative rather than quantitative basis, as noted by Kroll (1999), the occurrence of undeveloped grape seeds (e.g., Figure 6.50-d) is the strongest indication of the presence of hermaphroditic (self-pollinated) flowers, thus pointing to the identification of domesticated individuals in the archaeological population under consideration.

The presence at Niğde-Kınık Höyük of a rich grape (*Vitis vinifera*) seed dataset allowed me to apply the aforementioned linear measurements-based methods. The assemblage from Niğde-Kınık Höyük appears to be characterized by diverse grape seeds morphotypes (Figure 6.50), with notably an abundant presence of short and large specimens which are generally regarded as 'wild' morphotypes (Figure 6.50-a). Regardless of seeds morphology, the presence of cultivated populations at Kınık Höyük is out of any reasonable doubt, considering: (*i*) the occurrence of undeveloped seeds (*sensu* Kroll 1999), accounting to a total of 22 specimens originating from 7 samples dated from Period KH-P IV (800-500 BCE) to KH-P IIB (200-1 BCE) (Appendix 8) (Figure 6.50d); (*ii*) the location of Niğde-Kınık Höyük outside the expected distribution of wild grapevine populations (Zohary et al. 2000: 121-124); (*iii*) the absolute quantities and ubiquity of grape macro-remains (Appendix 7), which clearly indicates that viticulture was a central economic activity; and (*iv*) the historical and iconographic record (see above) which points to the local and regional importance of viticulture.

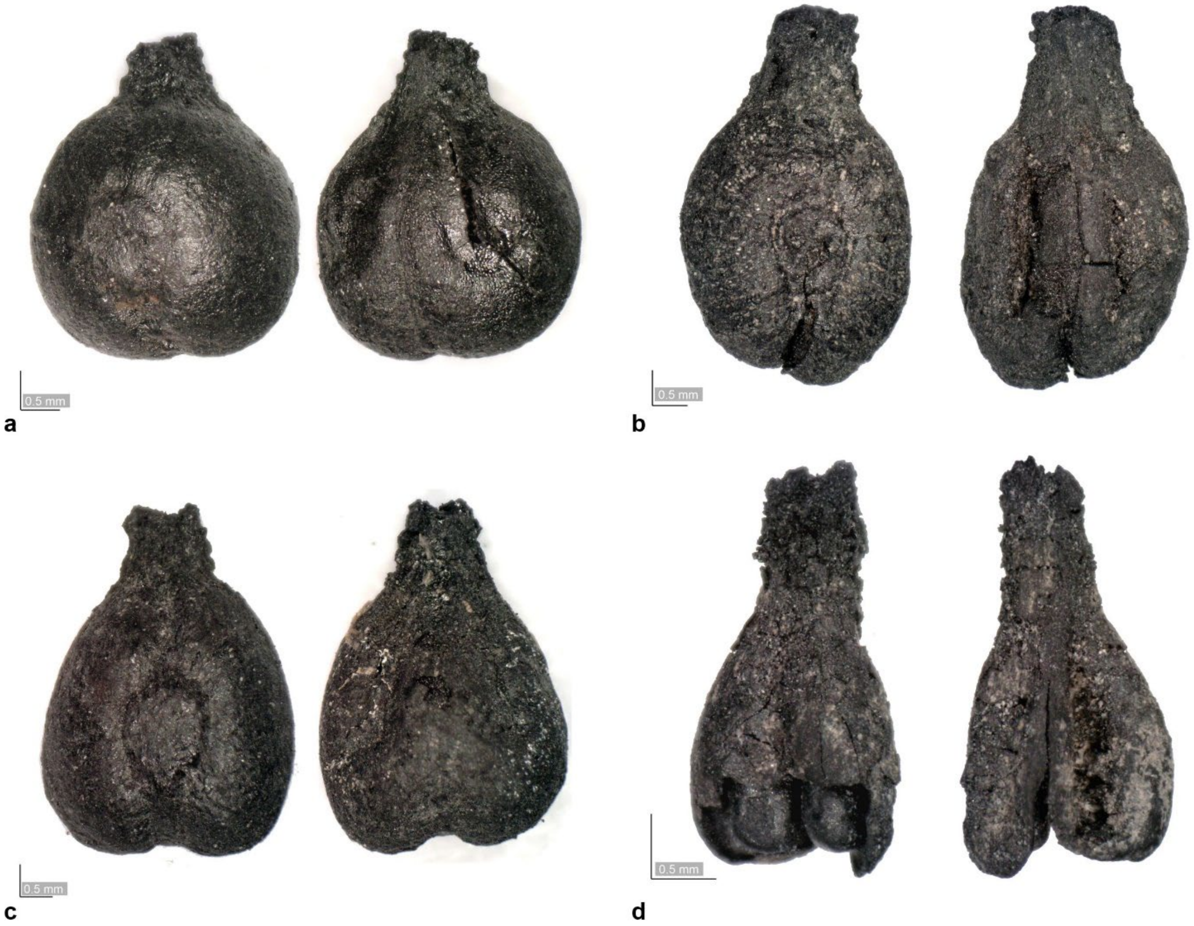


Figure 6.50 – *main morphotypes of grape seeds from Kınık Höyük: a, short and large morphotype ("wild-type") (KIN18A1379s31); b, elongated morphotype ("domesticated-type") (KIN13B807s175); c, intermediate morphotype, (KIN18A1379s31); d, undeveloped seed (KIN13B807s175).*

As a first step in the analysis, the Stummer Index (B/L*100) was calculated (Figure 6.51). Based on the threshold values provided in the literature (Stummer 1911), the majority of the specimens are attributed to the intermediate class; a sizable number of specimens are classified as wild; and only single seeds have an index lower than 54, indicative (following this methodology) of domesticated forms. The problems inherent to this method have been already discussed at the beginning of this section, it was thus hardly surprising to note the inability of this methodology to properly classify the assemblage.

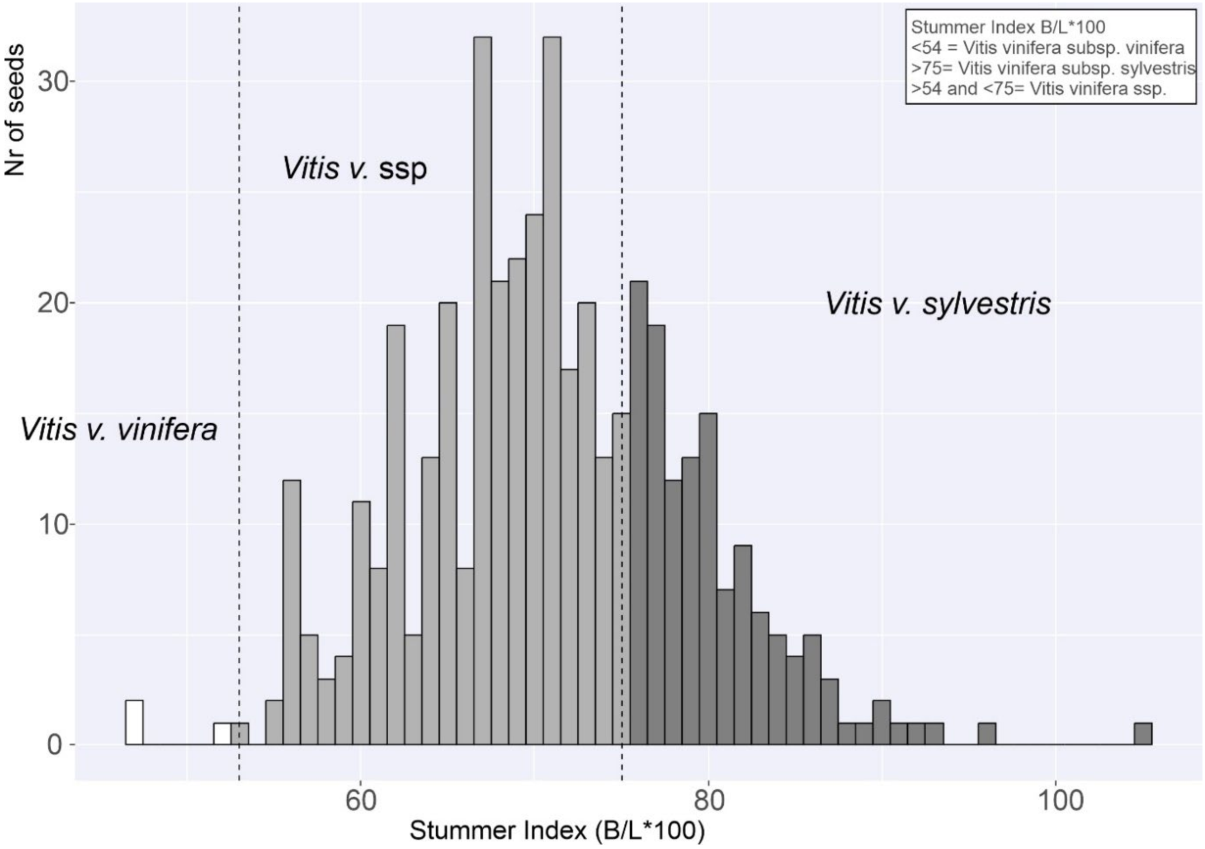


Figure 6.51 – *Attribution of the grape* (Vitis vinifera) *seeds specimens from Niğde-Kınık Höyük to wild and domesticated populations based on the Stummer Index* (*B/L*100*) (*Stummer 1911*)*. All entire seeds have been measured* (*data provided in Appendix 8*).

Grape specimens were subsequently tentatively attributed to either wild or domesticated forms following the more robust method provided by Mangafa and Kotsakis (1996), which was specifically developed in order to be applied to charred specimens. Regardless of the formula used, the specimens from Kınık Höyük are consistently attributed to wild grapevine (*V. vinifera* ssp. *sylvestris*), with only a handful of seeds returning values in the range considered by the author indicative of domesticated forms (Figure 6.52).

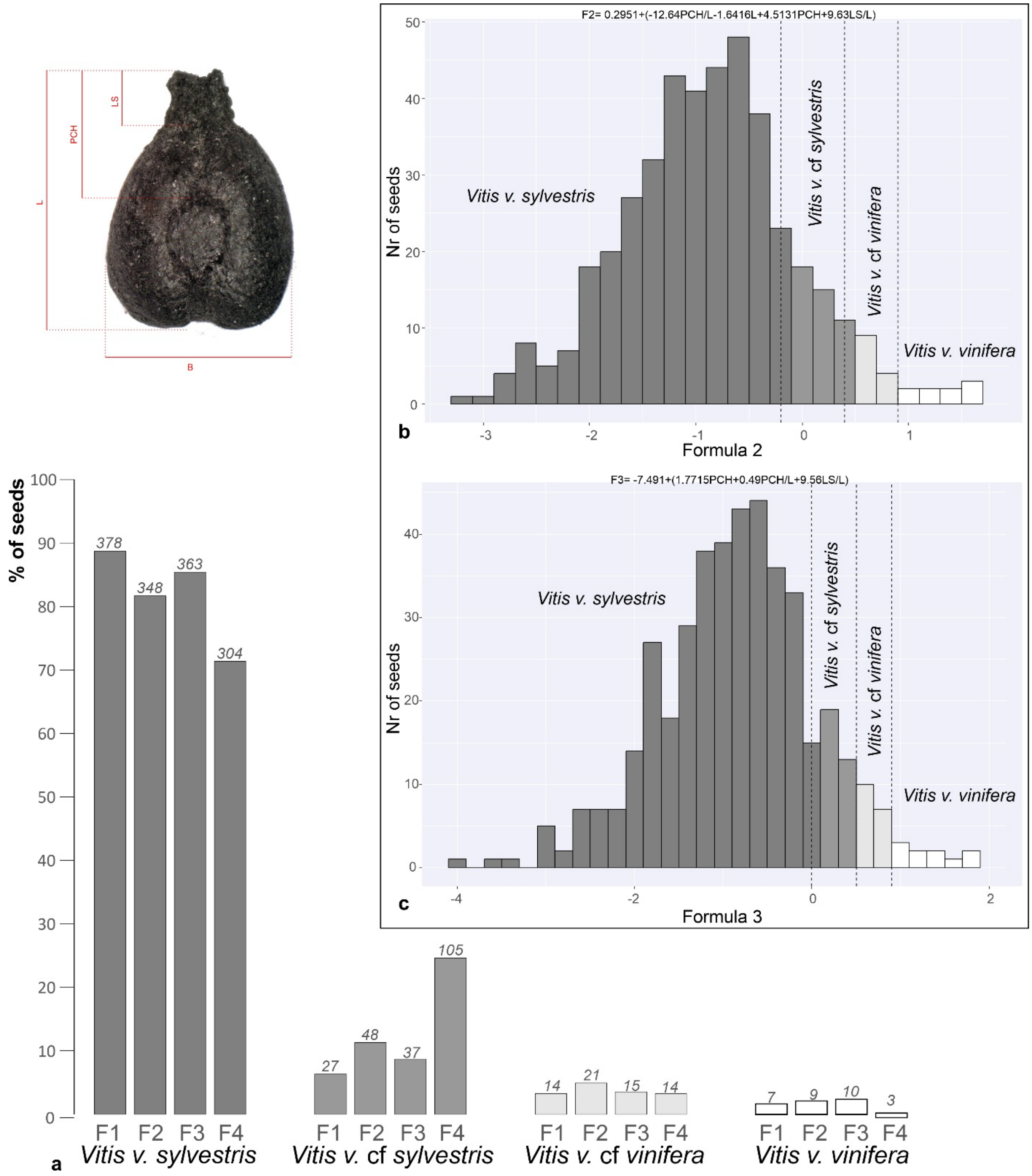


Figure 6.52 – *Attribution of the grape* (Vitis vinifera) *seeds specimens from Niğde-Kınık Höyük to wild and domesticated populations based on the formulae proposed by Mangafa and Kotsakis* (1996)*: F1 (Formula 1), F2 (Formula 2), F3 (Formula 3), F4 (Formula 4). I the two insets is represented a detailed distribution based on Formula 2 and Formula 3, regarded by the authors as statistically more reliable. All entire seeds have been measured (data provided in Appendix 8).*

As a final attempt, in Figure 6.53, I reported which of the specimens from the *Vitis* assemblage better matched wild or domesticated subspecies based on the method outlined by Perret (1997) – i.e., considering the ratio between the stalk and the total length of the seed. By applying a threshold value of 19, the 78% of the specimens are classified as originating from domesticated grapevines (*Vitis vinifera* ssp. *vinifera*) (Figure 6.53).

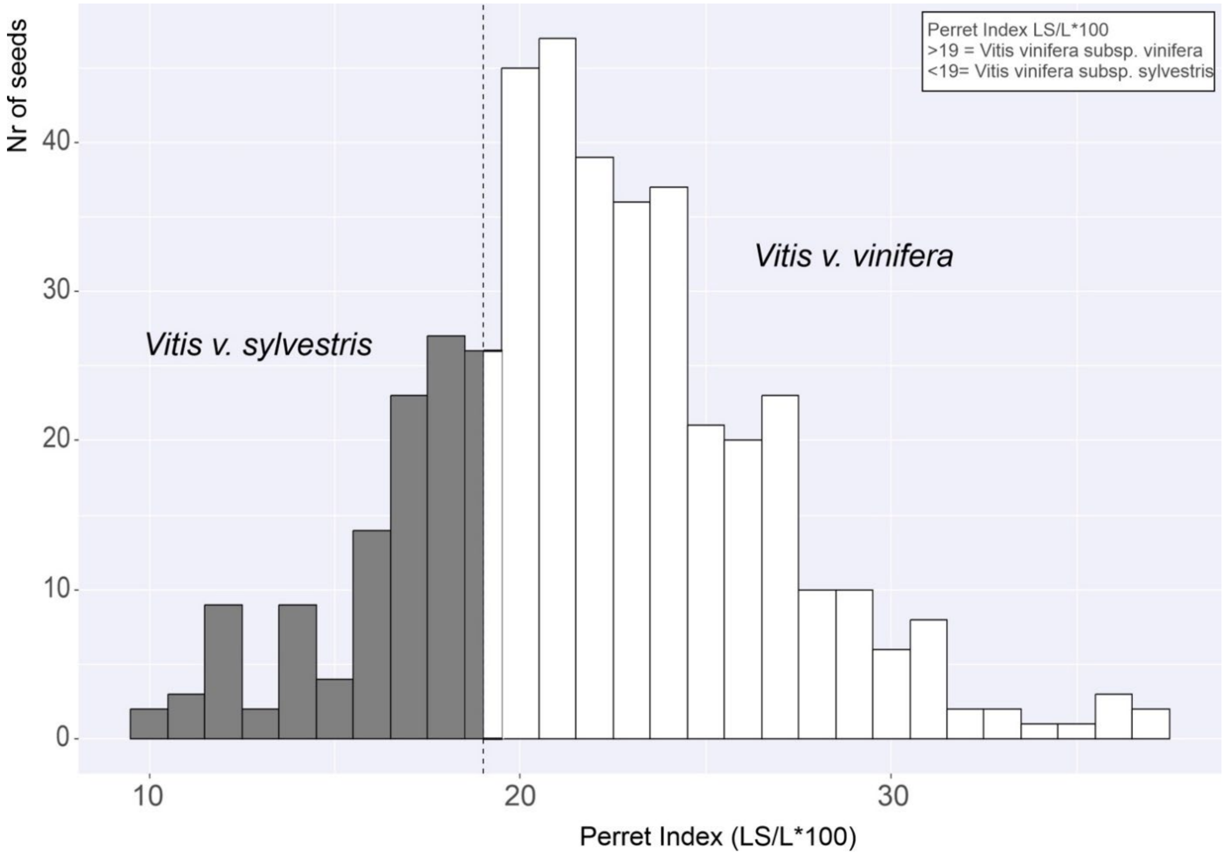


Figure 6.53 – *Attribution of the grape* (Vitis vinifera) *seeds specimens from Niğde-Kınık Höyük to wild and domesticated populations based on the ratio between stalk length and total length* (*LS/L**100) (*Perret 1997*).

Although the specimens of grape seeds from Niğde-Kınık Höyük are very likely to have been under cultivation regime and fully domesticated, their attribution to the domesticated type based on morphometric measurements has been particularly problematic. Only the method outlined by Perret (1997), based on the ratio between stalk and seed length, has proven to successfully attribute the majority of the specimens to the *V. vinifera* ssp. *vinifera* subspecies. The method proposed by Mangafa and Kotsakis (1996), on the other hand, although having been successfully applied elsewhere in the Mediterranean basin (e.g., Mangafa and Kotsakis 1996, Bellini et al 2008, Figueiral et al. 2010; Gismondi et al. 2016), has failed to identify the seeds from Niğde-Kınık Höyük as domesticated. The Evidence from Niğde-Kınık Höyük could, thus, represent an archaeological population(s) of domesticated grapevine bearing seeds of distinct morphology, reassembling wild morphotypes. Unfortunately, we lack other extensive dataset from central Anatolia with grape seeds measurements data – with the only exception in my knowledge being single specimens from Arslantepe (Belisario et al 1994) and Beycesultan (Helbaek 1961). It is highly interesting that very similar observations have been made for other southwestern Asian assemblages originating from historical sites, which are likewise dated to periods in which grapevine is expected to have been fully domesticated (e.g., Jacquat and Martinoli 1999).

In the last ten years morphometric analysis of grape seeds, and of archaeobotanical remains in general, has shifted from linear to geometric methods (e.g., Terral et al. 2010, Bouby et al. 2013, Pagnoux et al. 2015 and 2021, Ucchesu et al. 2015 and 2016, Bonhomme et al 2021). These latter methodologies, based on outline analyses (e.g., elliptical Fourier transforms), allows scholars to describe more accurately the morphotypes present in archaeological populations, returning numerically described shapes which can be statistically compared to a dataset populated with modern (wild and cultivated) and archaeological assemblages (Bonhomme et al 2021). This component of the research is not included in the dissertation. It is the intention of the author to pursue this latter line of research as part of a subsequent project, which would include also the dendrometric analysis of grapevine charcoal, following the methodology outlined by Limier et al. (2018).

6.5 Summary

In this chapter, I have provided the results of the carpological analysis conducted on samples from Niğde-Kınık Höyük, dated from the Early Iron Age (KH-P VB; 1200-1000 BCE) to Late Hellenistic (KH-P IIB; 200-1 BCE) periods, and to the Seljuk/Ottoman occupation phase (KH-P I; 1200-1450 CE). Single samples were analyzed also from the Late Bronze Age (KH-P VI; 1600-1200 BCE) and Roman (KH-P IIA; 1-300 CE) levels. The evidence presented in the chapter complements the results of wood charcoal analysis (Chapter 5), illuminating the agricultural landscape of Niğde-Kınık Höyük (Section 6.4.1), the plant-based activities that were conducted at different loci of the site (Section 6.4.3), and the local natural and ruderal vegetation (Section 6.4.3).

Free-threshing wheat (*Triticum aestivum/durum*) and 2-rowed hulled barley (*Hordeum vulgare*) are the two dominant economic taxa throughout the entire sampled sequence, with the former progressively increasing through time at the expenses of the latter. Hulled wheats are only sporadically attested. Millets (*Panicum miliaceum* and *Setaria italica*) are found through the entire investigated period, although in significant quantities only during the Early Iron Age (KH-P VB; 1200-1000 BCE). Rye (*Secale cereale*) is attested in significant amounts starting from the Late Hellenistic period (KH-P IIB; 200-1 BCE). Pulses are found ubiquitously, although generally in low counts. Bitter vetch (*Vicia ervilia*) and lentils (*Lens culinaris*) are the two most common pulses present in the assemblage, while peas (*Pisum sativum*), broad beans (*Vicia faba*), and chickpeas (*Cicer arietinum*) occur only sporadically. The fruit-tree record is dominated by grape (*Vitis vinifera*), abundantly found as seeds and pedicels. Both grape seeds and pedicels are first found during period KH-P VA (1000-800 BCE), and from then gradually increase and reach maximum values in the second half of the 1st millennium BCE (KH-P III and IIB), thus closely mirroring the trend observed in the wood charcoal record (Section 5.4.3). A further point of direct comparison between the wood charcoal and seed/fruit remains assemblage is the presence, starting from period KH-P III (500-200 BCE), of walnut (*Juglans regia*) and of Russian olive (*Elaeagnus angustifolia*). In sum, the carpological evidence indicates a progressive expansion of the cultivation of water-demanding crops throughout the 1st millennium BCE, peaking in the Achaemenid and Hellenistic period. Free-threshing wheat, 2-rowed hulled barley, and grape were the three hallmarks of this agricultural landscape (Section 6.4.1).

The carpological sequence from Niğde-Kınık Höyük is characterized by the presence of a particularly rich and diverse wild-weed flora (Section 6.4.2). Based on the ratio between wild-weed seeds and wood charcoal, it has been argued that ruminant dung burning represented the main taphonomic pathway underlying the deposition of these remains in the archaeological record (Section 6.4.2). A marked increase in seed-to-charcoal ratio is observed during period KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE), thus suggesting that an intensification of dung burning practice occurred in the second half of the 1st millennium BCE – intriguingly in concomitance to an intensification of anthropic activities in the landscape surrounding the site, which are paralleled by an increase in the use of grapevine pruning residues as fuel resource (Section 5.4.4). The occurrence of dung-burning is further supported by single sheep/goat dung pellets.

In addition to a diachronic trend, the archaeobotanical record is characterized by differences connected to the spatial origin of the samples (Section 6.4.3). It the chapter two specific cases have been discussed, respectively from KH-P III (500-200 BCE) and KH-P IIB (200-1 BCE). During KH-P III samples from Trench A1 are characterized by a higher contribution of fruit and nuts, minor presence of cereals, and low seed-to-charcoal ratios. Based on contextual evidence it has been proposed that the distinctive composition of samples from Trench A1 could be associated to some forms of cultic/ritual activities occurring in this area of the site. During period KH-P IIB, Trench A1 was occupied by a storage area. Based on the ubiquitous presence of grape seeds, and a minor contribution of cereals chaff and grains, it has been speculatively suggested that wine or other grape products could have been the main focus of the storage activities conducted in this area of the site.

Viticulture was a pivotal activity at Kınık Höyük (Section 6.4.4). Carpological evidence (seeds and pedicels) closely mirrors the trend in grapevine wood charcoal (Section 5.4.3). Based on the frequent cooccurrence of grape pedicels and seeds it has been tentatively proposed that wine production could have represented one of the main economic activities underlying grapevine cultivation in the landscape of Kınık Höyük. The importance of viticulture and winemaking in southern Cappadocia can be inferred also by iconographic and textual sources – spanning from the local, late 8th century BCE, cult of the Storm God of the vineyards to Ottoman tax record. Morphometric analysis of grape seeds suggest that they could belong to domesticated populations defined by a distinctive seed morphology.

PART III

Agriculture in central Anatolia, from the emergence of complex societies to the beginning of the Roman Rule

Figure III.1 – *View from Boğazköy*-Ḫattuša

CHAPTER 7

An agricultural history of pre-Roman central Anatolia

In Part I of the dissertation, I have provided an overview of the sources informing on the history of agriculture in central Anatolia (Chapter 2), focusing on the period extending from the Early Bronze Age (3000-2000 BCE) to the incorporation of the Hellenistic Kingdoms under the Roman Empire (1st century BCE/CE) (Chapter 1). In Part II, evidence from literature has been integrated and supplemented by original archaeological (Chapter 4) and archaeobotanical (Chapter 5 and 6) research conducted at the site of Niğde-Kınık Höyük, in southern Cappadocia (Chapter 3). Building on the previous two parts of the volume, with this chapter I aim to bring this dissertation to a conclusion, by providing a discussion of the socio-economic history of agriculture in central Anatolia.

The considerations that I am about to advance in this chapter are to be regarded as provisional. This work is intended to tentatively summarize the current state of the art on this very broad topic, on the basis of the evidence reviewed in the previous chapters. Archaeological and archaeobotanical research in Anatolia is currently in a growing phase (Section 2.1.2), it is, thus, implicit that a degree of revision of the overview here provided will be necessary as new data will emerge from ongoing and future research (Marston and Castellano 2021).

In the literature overview provided in Chapter 2, I have underlined some limits in the available datasets. To start with historical sources, the textual record from 2nd and 1st millennia BCE central Anatolia is characterized by a systematic paucity in administrative documents (Section 2.3). Regardless of whether this lacuna is due to preservation biases (e.g., use of wooden tablets, papyri, parchment; see

Marazzi 2007) or if it reflects an original (illiterate) Anatolian tradition of administrative practice (e.g., d'Alfonso and Matessi 2021), it remains an important gap in our knowledge of the local and regional agriculture. In fact, the absence of administrative records related to agriculture, which are conversely prominent in Mesopotamian cuneiform archives (see for example Widell 2012 for Ur III sources), limits our ability to reconstruct with at an adequate resolution several key technical and administrative aspects of Anatolian agropastoral economies – including the modalities of extraction/accumulation/redistribution of staple products, field productivity and yields, taxation and obligation regimes, and organization of the agricultural workforce.

Direct evidence on past agriculture can be found in the palynological (Section 2.2) and archaeobotanical (Section 2.2) records. Leaving aside general methodological limits that are implicit to these two fields (see Section 2.2), there are also in these regards some specific issues proper of the regional Anatolian dataset. For instance, Anatolian pollen sequences too often rely on few (or none) radiocarbon dates (Table 2.9), frequently conducted on bulk samples, which could return dates older than their actual deposition age (see Strunk et al. 2020). The chronological reliability of pollen records requires, thus, to be critically assessed on a case-by-case basis. Moving to archaeobotanical research, it has been already noted the far from satisfactory sampling of several periods (e.g., Middle Bronze Age, Achaemenid, and Hellenistic) and/or regions (e.g., Northern Anatolia) (Section 2.1) (Marston and Castellano 2021). As a consequence, despite a remarkable intensification of research in the past two decades (Section 2.1.2), the possibility to discuss both spatial and chronological trends is to a significant degree limited by the uneven geographic and chronological distribution of published records.

Bearing in mind these problematic aspects, in this chapter I aim to provide a diachronic reconstruction of Anatolian agricultural systems. This discussion will be organized into two main parts: (*i*) first, I will outline the main regional and supraregional trends in Anatolian and central Anatolian agriculture, based on archaeobotanical (Section 7.2.1) and palynological (Section 7.2.2) records. This overview is aimed at introducing the reader to the range of crops attested in the dataset, emphasizing some overarching trends documented within and beyond the Anatolian Peninsula; (*ii*) it will follow a more specific discussion of each single historical/cultural phase, from the Early Bronze Age (Section 7.3) to the Achaemenid and Hellenistic periods (Section 7.7). The evidence from central Anatolia will be compared to records from other Asia Minor regions and interpreted in light of the coeval socio-economic and historical context.

Throughout this chapter, I will make extensive use of archaeobotanical (carpological) evidence. Before proceeding any further, a methodological introduction is needed, in order to clarify how the single sequences have been handled in order to generate the elaborations that are included in this part of the dissertation.

7.1 Elaborations of carpological data: materials and methods

The archaeobotanical dataset has been presented at length in Section 2.1.3, further information is available in Appendix 1 (seed/fruit remains). Exclusively the sequences that have been published with quantitative data (either as count or weight) are included in this study. Archaeobotanical publications reporting data in form of presence/absence, semi-quantitative (arbitrary) scales, or discursive/graphic formats are not included in the dataset here considered. These latter records are, nevertheless, reported in Appendix 1, which provides full bibliography, chronology, geographic coordinates, and modern climate data (average January and July temperatures, annual precipitation). Data collection has been conducted in collaboration with John M. Marston (Boston University), as part of a joint project that resulted in the publication of an updated overview of archaeobotanical research in Anatolia (Marston and Castellano 2021).

In this chapter, I will consider exclusively economic taxa, which are here understood as plants that are known to have been systematically cultivated and/or exploited from the wild. This definition purposely accommodates for a degree of arbitrariness, given the number of wild plants of traditional importance in Anatolian rural economies (Ertuğ 2000). In order to facilitate data presentation and discussion, taxa are grouped into five categories: (*i*) cereal grains; (ii) cereal chaff; (iii) pulses; (*iv*) fruits-and-nuts; and (*v*) a miscellaneous category which encompasses oilseeds, herbs, spices, and fiber crops. Botanical names were standardized following Zohary et al. (2000), save cereals in which it was followed the traditional taxonomy (e.g., Jacomet 2006). The latter nomenclature, which is too a degree outdated, has been favored given its standard use in Anatolian archaeobotanical scholarship.

In single archaeobotanical reports, cereals and pulses were quantified exclusively as weights (Miller 2010). In these instances, a conversion ratio of 0.01g = 1 seed was applied, a figure which is based on empirical data provided by Miller (Stein et al. 1996: 255). Nutshell fragments were converted into whole nuts following Filipović (2014): 15 fragments = 1 *Pistacia* and 20 fragments = 1 *Amygdalus*, *Prunus*, or *Quercus*. Following Bouchaud et al. (2017), *Olea* endocarp fragment counts were converted to whole specimens at a ratio of 4:1. If no information was provided in the original archaeobotanical report, I assumed that the count values indicate either a minimum number of individuals or whole specimens. Grape berries were converted into seeds at a ratio of 1:4, while for *Cotoneaster* it was applied a ratio of 1:3. The single occurrences of *Ficus carica* syconia (infructescence) were not convert to 'seed' (technically fruits) counts, in order to avoid their overrepresentation in context already dominated by *Ficus*. Quantification of cereal chaff is particularly problematic, given the inconsistencies in data reporting. The only feasible (and far from ideal) solution to this issues was, thus, to count altogether as "chaff fragments" spikelet forks, glume bases, and unspecified chaff parts.

To limit redundancy and noise in the dataset, a minimum taxonomic threshold was established. In cereals, specimens identified at or above the genus level were excluded from elaborations – with the sole exception of *Panicum*/*Setaria*. The same taxonomic cutoff level was used for oilseeds, herbs, and spices – with the exception of *Gossypium* sp. In pulses and fruits-nuts, specimens identified at the genus level (e.g., *Prunus* sp. and *Lens* sp.) were included in the dataset. Identifications noted in the original publication as tentative (i.e., '*cf.*') were combined with positive identifications, if the latter are present in the same report. Otherwise, they were removed from the dataset.

The dataset resulting from the aforementioned process of taxonomic amalgamation and harmonization is presented through this chapter in the form of: (*i*) summary tables, (*ii*) bar graphs, and (*iii*) multivariate plots.

Summary tables are provided for each chronological period considered in the dissertation project – i.e., Early, Middle, Late Bronze Age, Iron Age, and Achaemenid/Hellenistic. These tables are intended to provide a synthetic overview of the carpological assemblages attested at each site, reporting both presence/absence and quantitative information. In these tables, for quantification purposes, I have proceeded as follows: (*i*) if in the sum of the specimens attributed to a given group (cereal, pulses, fruits-nuts, and miscellaneous) exceeds the arbitrary cutoff value of 100, data are provided as relative abundances calculated using the group total as sum; (*ii*) if the total is less than 100, abundances are reported using a semi-quantitative scale (*= 1, += 2 to 9, ++= 10 to 24, +++= 25 to 49, ++++= >49). The instances in which cumulative values are strongly impacted by single large caches of seeds are noted in the text. Chaff remains are not included in these tables.

The archaeobotanical dataset is further presented in the form of bar graphs, which are provided as separate figures for (*i*) cereals, (*ii*) pulses and miscellaneous taxa, and (*iii*) fruits-nuts. Cereal grains are presented as relative abundances calculated using as sum the total of cereal grains. In the same figures, chaff data are reported using a count-based semi-quantitative scale (1-9, 10-49, 50-99, 100-999, and >1000 remains). Bar graphs of fruits and nuts, pulses, and miscellaneous taxa are based on relative abundances calculated using the total of the selected economic taxa as sum (chaff excluded). Sequences having less than 50 specimens are not included in these elaborations.

The archaeobotanical dataset has been subjected to multivariate analysis. Based on a better performance (i.e., variance explained), it was opted to perform a Principal Component Analysis (PCA). Chaff remains, miscellaneous taxa (oilseeds, herbs, and spices), and taxa occurring in less than the 10% of the samples were removed from the dataset. Assemblages having less than 100 specimens meeting the minimum taxonomic threshold were omitted. Prior to computation, count values were subjected to Hellinger transformation, a recommended step for the ordination of species abundance data through linear models (Legendre and Gallagher 2001; Borcard et al. 2011, Legendre and Birks 2012). PCA was performed on the covariance matrix. Results are presented as a correlation biplot ('scaling 2' in Oksanen et al. 2019), thus maintaining the angle between descriptor vectors (species) reflecting their correlation. If conducted, ad hoc manipulations of the dataset (e.g., deletion of outliers/extreme observations) are reported in figure captions. Multivariate analysis was carried out in R 3.5.1, package Vegan, version 2.5.5 (Oksanen et al. 2019).

7.2 Anatolian agriculture: an overview

7.1.1 *Which crops were farmed? The regional and supraregional diachronic trend*

Before moving to a detailed analysis of the single historical periods covered by the dissertation project, I considered it useful to provide a more general overview of the main diachronic trends detected in the regional and supraregional archaeobotanical record. In order to provide such panoramic view on farming in ancient Anatolia, I will follow the overview recently provided by Marston and Castellano (2021). The latter publication is an updated synthesis of the archaeobotanical evidence available from the entirety of modern Turkey, spanning from the Paleolithic to the Ottoman period.

The presence of uneven sampling intensities across different sites/site phases and the occurrence of single caches of relative pure crop seeds are two well-known challenges to regional meta-analysis of archaeobotanical assemblages (e.g., Heiss and Stika 2013). In Marston and Castellano (2021), these issues were partially mitigated by applying the Representativeness Index (RI) statistic: a weighted ranking system that aims to account for differences in sampling intensities and absolute quantities of finds across sites (Heiss and Stika 2013, Stika and Heiss 2013, Effenberger 2018). In extreme synthesis, RI scores (1 to 7 in Marston and Castellano 2021) are assigned based on count values; the obtained scores are subsequently multiplied by an RI factor (x2, x4, x5 in Marston and Castellano 2021), which is determined by the number (amount) of samples (sediment) processed (Table 7.1). The RI values obtained can be finally summed by region and/or period.

Specimens per category per site-period	< 1000 specimens per category	≥ 1000 specimens per category
RI scores		
1	<10 specimens	<10 specimens
2	10-49 specimens	10-49 specimens
3	50-99 specimens	50-99 specimens
4	100-499 specimens	100-499 specimens
5	≥500 specimens	≥500 specimens
6		25-49% of category specimens
7		≥50% of category specimens
RI factors	**Per site**	
x 2	≥20 samples or ≥1000 L sediment	
x 4	≥40 samples or ≥5000 L sediment	
x 5	≥50 samples	

Table 7.1 – *Representative Index (RI) scoring matrix used in Marston and Castellano 2021. 'Category' refers to one of: cereals, pulses, fruits and nuts, oilseeds and fiber crops. (From Marston and Castellano 2021).*

Leaving for Marston and Castellano (2021) a more detailed discussion of this methodology, in the following paragraph, I will summarize the main regional diachronic trends reconstructed using RI indexes. I will discuss separately cereals (Figure 7.1), pulses (Figure 7.2), fruits-nuts (Figure 7.3), and oilseed and fiber taxa (Figure 7.4).

- *The Anatolian Peninsula: the cereals assemblage*

Figure 7.1 summarizes the main diachronic trends in Anatolian cereal assemblage. From the onset of agricultural economies, wheat and barley are the main staple grains. Alternative cereals are attested in meaningful values only at a comparatively late chronological stage: broomcorn and foxtail millet appear to have acquired a degree of economic importance only from the Iron Age onwards; at a yet later stage, it is registered an increased occurrence of domesticated rye. On the basis of the available record, oat played a minor role (if any) in the regional agriculture, at best limited to the Medieval period.

As already noted in Chapter 6, domesticated barley (*Hordeum vulgare*) can be classified on the basis of the number of fertile florets present at each rachis node (two- and poly-rowed varieties) and the toughness of the glumes (naked and hulled varieties) (Jacomet 2006). Naked barley represented a staple crop in the Neolithic and Early-Middle Chalcolithic periods, for then falling out of use starting in the 4th millennium BCE, in Anatolia (Figure 7.1) (Marston and Castellano 2021: 344-345) as well as elsewhere in western Asia (Lister and Jones 2013). On the contrary, as noted by Lister and Jones (2013), mixtures of hulled and naked barley are comparatively commonly attested at European sites up to the Iron Age/Roman period. In Central Asia, as in Europe, hulled forms become more prominent at most cites starting in the Iron Age (Spengler 2015), but in Tibet (Tang et al. 2020) and across East Asia (Lister et al. 2018) naked forms remain dominant

The processes underlying the switch in emphasis from naked to hulled barley, in Anatolia and elsewhere in western Asia, remain to date poorly understood. Lister and Jones (2013: 444) summarized the main hypothesis that have been put forward in the literature, namely: (*i*) the greater environmental tolerance of hulled barley; (*ii*) the better response of hulled cultivars to field manuring; (*iii*) their suitability as fodder resource; and (*iv*) a lower grain loss during harvest through metal sickles or other similarly vigorous techniques. Regardless of the factors driving this change, in the chronological period covered by the dissertation project (ca. 3000 to 1 BCE), the hulled form is overwhelmingly attested, with only sporadic occurrences of naked cultivars, often in form of single specimens – at Taşkun Mevkii (Nesbitt et al. 2017), Boğazköy (Hopf 1992, Diffey et al. 2020), Oymaağaç (Czichon et al 2017), Beycesultan (Helbaek 1961), Korucutepe (van Zeist and Bakker-Heeres 1975), and Kınık Höyük (Chapter 6).

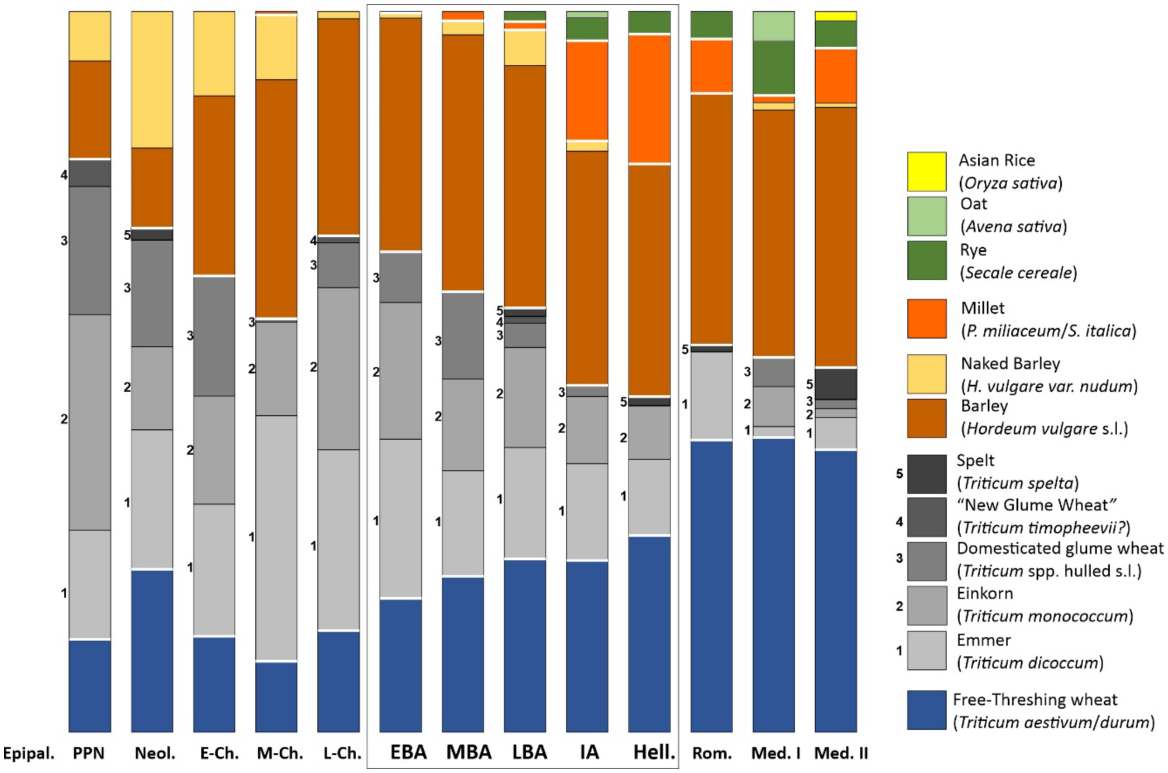


Figure 7.1 – *relative abundance of cereal taxa based on summed RI scores by period, after Marston and Castellano 2021. The period covered by the dissertation is indicated by the black box.*

The distinction between two and poly-rowed barley can be conducted on both caryopses (ratio between twisted and straight grains) and chaff (e.g., diameter of lateral floret bases) (Jacomet 2006). These attributions are, however, not always provided in published archaeobotanical reports. Despite the unsystematic recording, available data indicates that two-row barley was predominant in Anatolia. This preference could have been in a significant degree promoted by the lower water-requirements of two-row cultivars, while on the contrary poly-rowed barley in semi-arid contexts generally requires a degree of artificial watering (Harlan 1968). Single assemblages dominated by 6-row barley are, nevertheless, attested. Most notably, poly-rowed barley appears to have represented a staple crop during the final phase of the Late Chalcolithic period at Arslantepe (VI A) (Follieri Coccolini 1983, Sadori et al. 2006a), in the Upper-Middle Euphrates Valley. The occurrence of six-row barley at Arslantepe has been connected to the presence of irrigation (Balossi Restelli 2010). Six-rowed barley is furthermore reported as predominant at EBA III and MBA Kültepe (Fairbairn 2014: 184). Chaff identified as poly-row barley is documented also in the 2nd and 1st millennia BCE sequence from Gordion, although quantitatively secondary in comparison to two-row cultivars (Miller 2010: 44).

Wheat is the second pillar of Anatolia and western Asia agriculture. The summary provided in Figure 7.1 clearly supports the well-known trend of a slow yet steady replacement of hulled wheats by free-threshing cultivars (Nesbitt and Samuels 1996b, Marston and Castellano 2021). The main domesticated hulled wheats are documented in the Anatolian record, namely: einkorn (diploid; *Triticum monococcum*), emmer (tetraploid; *T. dicoccum*), spelt (hexaploid; *T. spelta*), and the so-called 'New Glume Wheat' – a currently relict, tetraploid hulled wheat which attribution to the *T. timopheevii* group has been recently confirmed by genomic analysis (Czajkowska et al. 2020). Einkorn (*T. monococcum*) and Emmer (*T. dicoccum*) represented by far the predominant hulled wheats, across different periods and Anatolian regions.

Pure stores of 'New Glume Wheat' have been identified at Neolithic levels of Çatalhöyük, which would support a self-standing crop status of this taxon in the incipient phase of central Anatolian farming (Bogaard et al. 2017: 12-13). In addition to Çatalhöyük, chaff remains attributed to 'New Glume Wheat' have been reported from the Neolithic sites of Caferhöyük, in the Middle-Upper Euphrates Valley (de Moulins 1993); at Aşıklı Höyük (Ergün et al 2018) and Buncuklu (Baird et al. 2018), in central Anatolia; Yenikapı (Ulaş and Fiorentino 2021) in the Marmara region; and Mersin-Yumuktepe (Ulaş and Fiorentino 2021) in Cilicia. Diagnostic spikelet bases of New Glume Wheat are attested in meaningful quantities up to the Late Chalcolithic period (Çadır Höyük, von Baeyer et al. 2021; Çamlıbel Tarlası, Stroud 2016), for then disappearing from the Anatolian archaeobotanical record, with the singular exception of an isolated occurrence at Late Bronze Age Tell Atchana (Stirn 2013). It should be noted that New Glume Wheat is likely to be underreported in archaeobotanical records, given the relatively recent formal identification of this taxon in the literature, which is still more safely conducted on chaff rather than grains (Jones et al. 2000).

Spelt (*Triticum spelta*), an hexaploid hulled wheat, is only sporadically attested in the Anatolian archaeobotanical dataset (Figure 7.1), in line with the generalized poor documentation of this crop in western Asia (Zohary et al 2000). The available evidence would accordingly support a minor role of spelt in Asia Minor cereal farming. With the sole exception of large concentrations from the Byzantine levels of Kilise Tepe (Bending and Colledge 2007), this crop is reported only as single grains (Erbaba, Neolithic, van Zeist and Buitenhuis 1983; Kuşaklı, Late Bronze Age, Müller-Karpe et al 1998; Kilise Tepe, Late Bronze Age, Bending and Colledge 2007, Tatarli Höyük, Hellenistic, Aslan 2012; Pessinonte, Roman, Van Peteghem 2005) and chaff (Kuşaklı, Late Bronze Age, Müller-Karpe et al 1998).

Starting from the Early Bronze Age (Figure 7.1), scholars have recorded a steady increase of importance of free-threshing wheat over hulled cultivars (Fairbairn 2021: 220; Marston and Castellano 2021: 344-345). This process appears concluded by the beginning of the Iron Age (ca. 1180 BCE), with free-threshing wheat predominant across Anatolia. Singular exceptions to this trend are the Early Iron Age levels from Kuşaklı, in east-central Anatolia (Müller-Karpe et al 1998); the Iron Age occupation of Kilise Tepe, in Cilicia (Bending and Colledge 2007); and Hellenistic samples from Tatarli Höyük (Aslan 2012)[34].

Hulled wheats are characterized by having a persistent hull. In other words, their threshing results in single spikelets, in which the grain(s) are enclosed by tough glumes that remain attached to the rachis fragment. On the contrary, in free-threshing wheat, the glumes break during threshing, resulting in 'clean' grains. The processing of hulled wheats accordingly requires an additional step (dehusking), which is aimed at freeing the grains from the spikelets. A growing body of evidence suggests that hulled wheat was commonly stored as spikelets rather than clean grains. This practice would enhance the preservation of the grains, considering that the tough chaff provides protection from moisture, insects, and promotes an overall longer viability of the grains (Nesbitt and Samuels 1996b). Large stores of spikelets of einkorn and emmer are documented in various Anatolia sites – e.g., in the Late Bronze Age granaries from Boğazköy (Diffey et al. 2020). Dehusking was, thus, likely more commonly conducted prior to the consumption/use of the grains. Ethnographic evidence suggests that this step in cereal processing was conducted using mortars or similar implements (Nesbitt and Samuels 1996b: 48-53). Nesbitt and Samuels (1996b) provide a detailed overview on hulled wheats processing, to which I refer the reader for further information.

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[34] In a later publication (Aslan et al. 2014) specimens identified in Aslan 2012 as *Triticum dicoccum* appears to have been reassigned to *Triticum* sp.

The factors promoting the switch from hulled to free-threshing cereal varieties are still debated. Various hypotheses have been put forward (e.g., Fairbairn 2021: 220; Marston 2021), such as: (*i*) the lower labor requirement for processing free-threshing wheat (i.e., dehusking not necessary); (ii) different timing of processing tasks, on both a daily and seasonal basis (see Marston 2021: 360-361); (*iii*) the susceptibility to drought stress of Einkorn; and (*iv*) differences in flour properties and taste. Regardless of the specific processes in place, the available evidence supports the presence of a slow trend rather than an abrupt switch in preferences. The period covered by the dissertation project overlaps with the central phase of this transition (Figure 7.1).

Published evidence indicates a rather late inclusion in Anatolia of farming cereals other than barley and wheat. Millets (*Panicum miliaceum* and *Setaria italica*) and rye (*Secale cereale*) gained importance during the post-Bronze Age periods. In the Medieval period, oat (*Avena sativa*) and Asian rice (*Oryza sativa*), might have played a localized (minor) role in Anatolian farming (Figure 7.1) (Marston and Castellano 2021: 344-345).

The specific case of millets necessitates a brief discussion. The former hypothesis of two Eurasian centers of domestication (e.g., Hunt et al. 2007) has been disregarded based on radiometric and taxonomic scrutiny of available evidence (Motuzaite-Matuzeviciute et al. 2013, Filipović et al. 2020). Conversely, there is growing consensus in reconstructing an eastern Asian (northern China) domestication center of both foxtail and broomcorn millet (Stevens et al. 2021, with additional references). Leaving aside single (non-radiocarbon dated) Chalcolithic (Mersin-Yumuktepe, Fiorentino et al. 2014), Early Bronze Age (Sos Höyük, Longoford 2015), Middle Bronze Age (Sos Höyük, Longoford 2015; Ziyaret Tepe, Rosenweig 2014; Troy, Riehl 1999), and Late Bronze Age (Troy, Riehl 1999; Ziyaret Tepe, Rosenweig 2014; Kuşaklı, Müller-Karpe et al 1998; Kilise Tepe, Bending and Colledge 2007) occurrences, millets appear to have played a more important role in Anatolian farming from the Iron Age onwards (Figure 7.1) (Nesbitt and Summers 1988, Miller et al. 2016, Marston and Castellano 2021). The status of millet as a crop in 1st millennium BCE Anatolia is unequivocally supported by the occurrence of large pure stores in the Urartian levels of Ayanis (*Panicum*/*Setaria*, Solmaz and Oybak Dönmez 2013), Neo-Assyrian Tille Höyük (*Setaria italica*, Nesbitt 2016), and Hellenistic strata from Aşvan Kale (*Panicum miliaceum*, Nesbitt et al. 2017). Millets are warm season crops, sensitive to frost and requiring warm temperatures for germination (for *Panicum*, see Habiyaremye et al. 2017: 3). Their cultivation as summer crops in Anatolia would have implied the presence of a degree of irrigation, given the overlap of their growth cycle to the dry-hot season proper of the western Asia and Mediterranean climate (Miller et al. 2016). I will further expand on this topic in a later section of this chapter.

- *The Anatolian Peninsula: pulses*

Figure 7.2 summarized the pulses assemblages from the Anatolian Peninsula (Marston and Castellano 2021). Pulses tend to be underrepresented in archaeobotanical assemblages, due to frequent fragmentation and related identification issues (e.g., Fairbairn 2021: 221-222). Nevertheless, it is no doubt that domesticated Fabaceae represented an important component of western Asia and Anatolian agricultural systems: complementing cereals in field rotation systems, providing a protein meat-substitute to human diet, as well as a nutrients rich fodder resource (e.g., Palmer 1998, Zohary et al 2000). In the Anatolian archaeobotanical record, the pulse assemblage is dominated by the four founder species of western Asia agriculture (Zohary et al 2000): lentil (*Lens culinaris*), bitter vetch (*Vicia ervilia*), pea (*Pisum sativum*), and chickpea (*Cicer arietinum*) (Marston and Castellano 2021: 346-347). Fava bean (*Vicia faba*) and common vetch (*V. sativa*) occurs at single sites (Marston and Castellano 2021: 346-347), with an importance that appears more limited and/or geographically circumscribed.

Lentils and bitter vetch are by far the most common pulses. Their predominance is likely to reflects their suitability to cultivation under a range of different environmental conditions, including semi-arid contexts (Riehl 2009: 98, Castellano and Marston 2021). As I have already mentioned in Chapter 6, although currently cultivated for fodder, bitter vetch are understood to have formerly represented an important crop for human consumption. Because of toxins present in the seeds, soaking, leaching, and steaming are required prior to their consumption (Zohary et al 2000: 92).

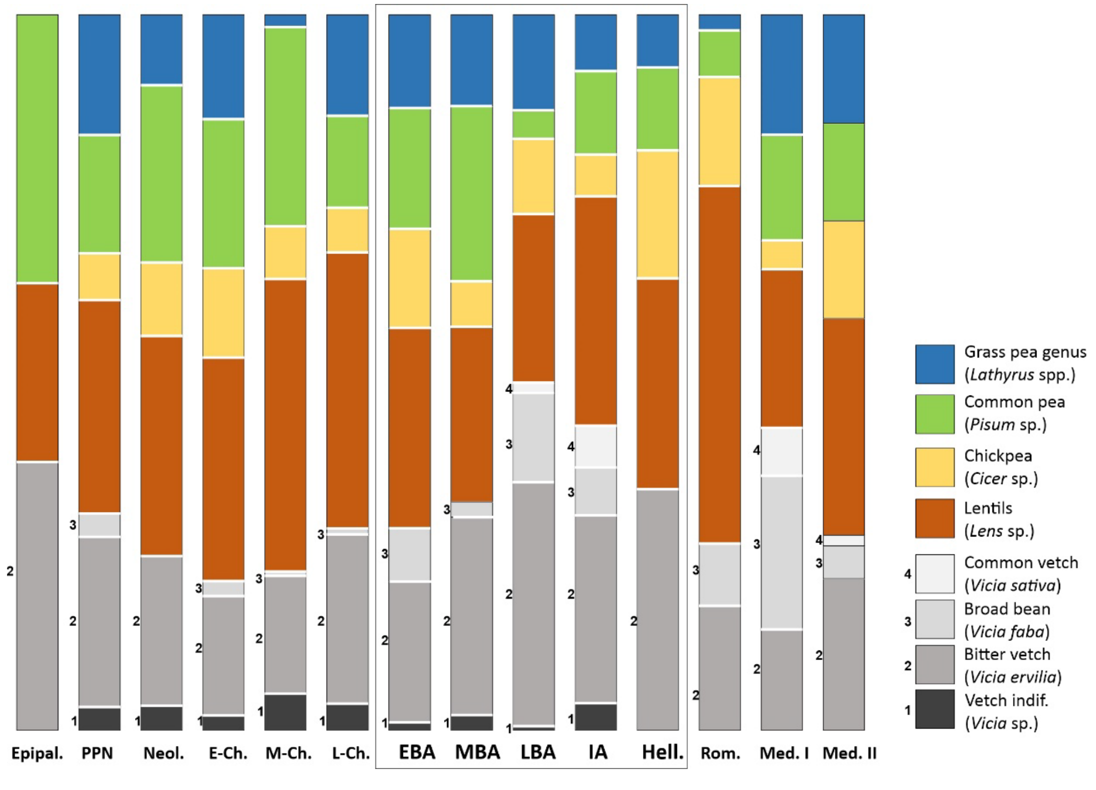


Figure 7.2 – *relative abundance of pulses taxa based on summed RI scores by period, after Marston and Castellano 2021. The period covered by the dissertation is indicated by the black box.*

Field pea (*Lathyrus cicera/sativus*) is comparatively commonly attested across Anatolian sites. Based on seed anatomy, the distinction between *L. cicera* and *L. sativus* is problematic (e.g., Nesbitt 2016: 387). *Lathyrus cicera* is known in contemporary Turkey as an agricultural weed, while *Lathyrus sativus* is currently mostly cultivated as fodder (Nesbitt 2016: 387). Similar to bitter vetch, however, if properly processed, the latter crop is palatable to humans. The consumption of *Lathyrus sativus* is still documented in traditional cuisine in southern Asia and elsewhere (Nesbitt 2016: 387). The presence of pure stores of field peas (e.g., Ilipinar, Early Chalcolithic, Cappers 2008; Kuruçay Höyük, Late Chalcolithic, Stroud 2016; Tille Höyük, Hellenistic, Nesbitt 2016) supports the status of this plant as crop, whether intended for animal or human consumption.

- *The Anatolian Peninsula: fruits-nuts*

Figure 7.3 summarized the diachronic trend in fruits and nuts assemblages (Marston and Castellano 2021). The main, macroscopic, diachronic trend is the transition from the exploitation of oil and protein-rich wild taxa (e.g., wild almond, hackberry, and terebinth) to orchard crops (Figure 7.3) (Fairbairn 2021: 222-223, Marston and Castellano 2021: 347-348). The establishment of orchards in the circum-Mediterranean and southeastern regions of Asia Minor appears to have occurred as early as the Late Chalcolithic period, becoming fully established in the Early Bronze Age (Marston and Castellano 2021: 347-348) (Figure 7.3). This chronology is in accordance with the general trend documented in the broader eastern Mediterranean (Fuller and Stevens 2019).

Olive (*Olea europaea*), grape (*Vitis vinifera*), and fig (*Ficus carica*) are the backbone in Mediterranean arboriculture (Figure 7.3). Within Asia Minor, important regional differences are present, most likely chiefly determined by moisture requirements and sensibility to winter frost. Among arboreal crops attested at single sites, to be mentioned are pomegranate (*Punica granatum*), hazelnut (*Corylus* sp.), walnut (*Juglans regia*), Russian olive (*Elaeagnus angustifolia*), and various rosaceous taxa.

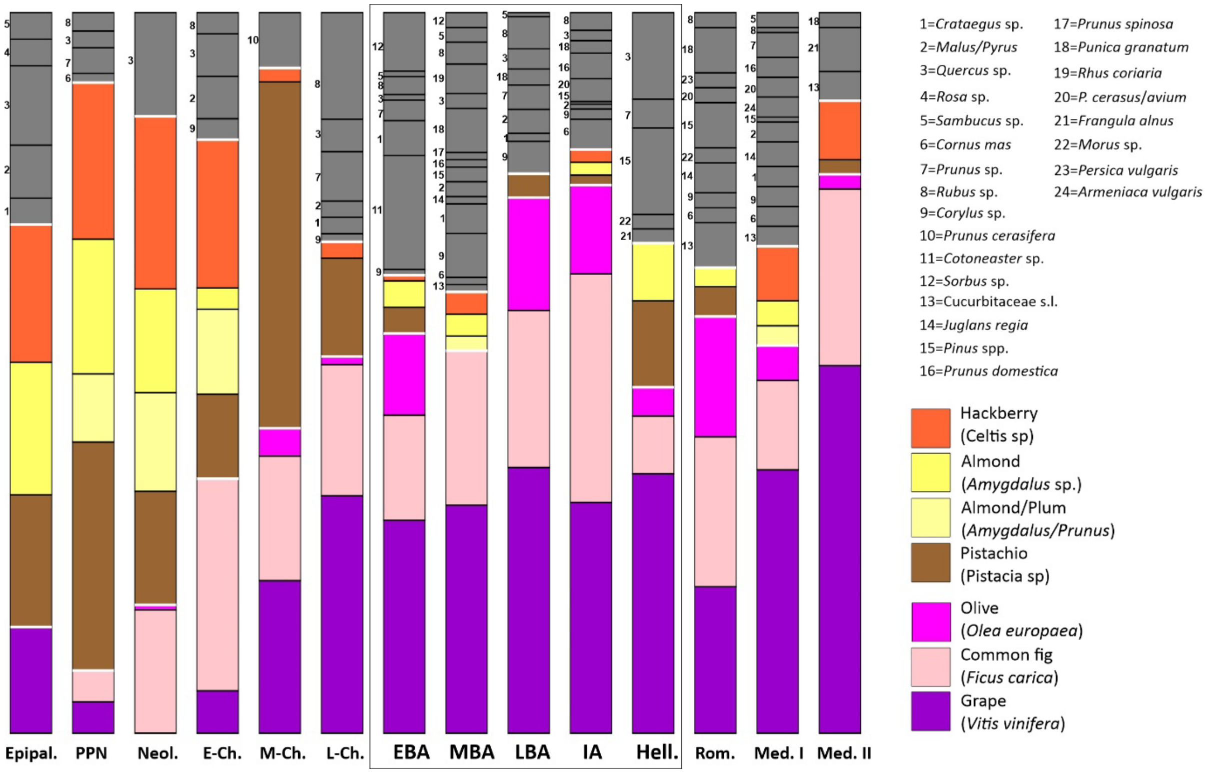


Figure 7.3 – *relative abundance of fruits and nuts taxa based on summed RI scores by period, after Marston and Castellano 2021. The period covered by the dissertation is indicated by the black box.*

- *The Anatolian Peninsula: oilseeds and fiber crops*

Figure 7.4 summarizes the diachronic trends of oilseeds and fiber crops (Marston and Castellano 2021). These taxa are generally found sporadically, although at times in single large caches. In addition to flax (*Linum usitatissimum*), which could have been exploited as oil and fiber source, flixweed (*Descurania sophia*) represented a comparatively important oilseed during the Neolithic and Early Chalcolithic periods, as suggested by pure stores found at Çatalhöyük (Fairbairn et al. 2007, Bogaard et al. 2017). Gold-of-pleasure (*Camelina sativa*) could have been a further plant exploited as oilseed, as suggested by large concentrations from Kuruçay Höyük (Late Chalcolithic, Stroud 2016), Küllüoba (EBA, Çizer 2015), and Yoncatepe (MIA, Oybak Dönmez and Belli 2007).

Cotton (*Gossypium* sp.) is a much later addition to the Anatolian (and western Asia) crop assemblage. The cultivation of cotton in Asia Minor is documented in the Medieval period, as suggest by caches found at Aşvan Kale (Seljuk/Ottoman period, Nesbitt et al. 2017), Kinet Höyük-Tüpraş Field (Abbasid/Byzantine, Ramsay and Eger 2015). Cotton is, furthermore, attested at Gordion (Seljuk/Ottoman period; Miller 2010, Marston 2017) and Gritille (Byzantine, Miller 1998). Pending AMS dating, the singular occurrence of a *Gossypium* seed at Hellenistic Aşvan Kale (Nesbitt et al. 2017) is to be cautiously considered, given its abundant occurrence in Medieval strata from the same site.

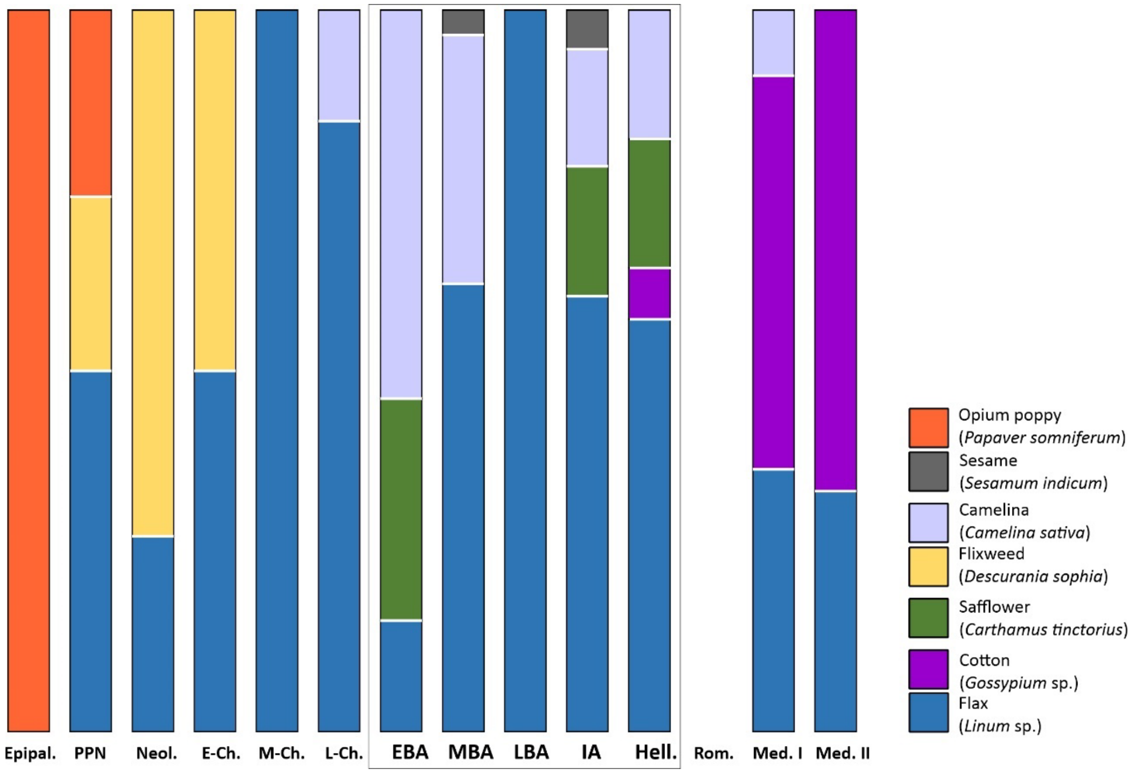


Figure 7.4 – *relative abundance of oilseeds and fiber taxa based on summed RI scores by period, after Marston and Castellano 2021. The period covered by the dissertation is indicated by the black box.*

- A closer look to the Anatolian Plateau: the main trends

In the previous section, based on the elaborations provided by Marston and Castellano (2021), I have summarized the long-term trends in the Anatolian archaeobotanical record, encompassing the entirely of modern Turkey. A more specific focus on the central Anatolian records, spanning from the Bronze Age to the Hellenistic period, is provided in the multivariate plot presented in Figure 7.5.

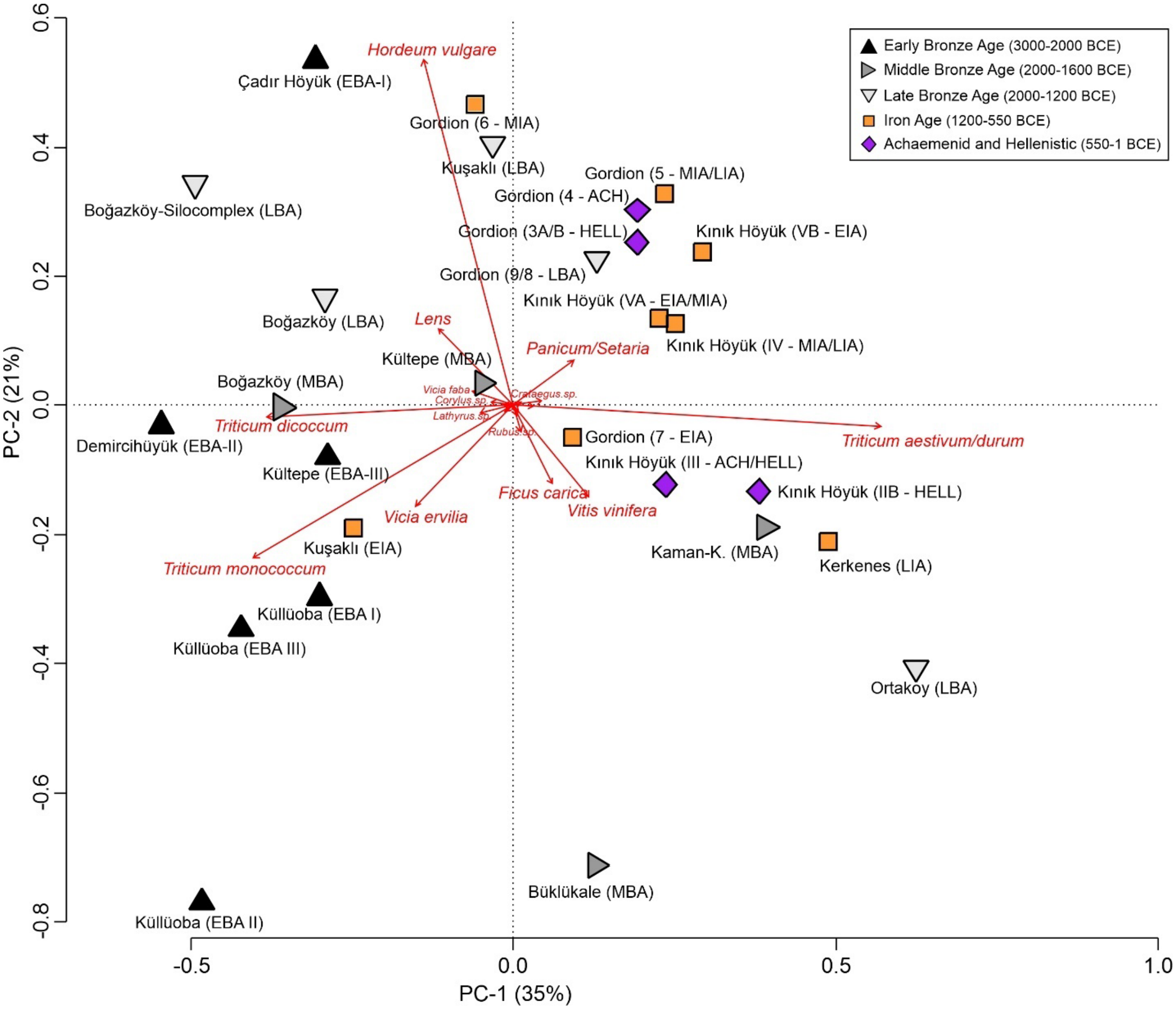


Figure 7.5 – *PCA of assemblages from central Anatolia (EBA to Hellenistic); cereals, pulses and fruits-nuts taxa are included. Small angles between vectors indicate positive correlation, opposite angles negative correlation, right angles lack of correlation. Right-angled projections of a sample on the vector of a taxon approximates the value of that taxon in the sample. Grains identified as* Triticum monococcum/dicoccum *were reassigned based on the ratio between the two crops in the specific assemblage.*

As I will discuss through this chapter, central Anatolia is characterized by distinctive agricultural systems, rooted in both their environmental specificities (e.g., a semi-arid climate with particularly cold winters) and a variable degrees of cultural proclivity. The supraregional trends noted in the previous section are, nevertheless, confirmed also by considering exclusively the evidence from the Plateau.

The first axis of the PCA plot, which explains the 35% of the variance in the dataset, strongly correlates with the contribution of hulled (negative values) and free-threshing (positive values) wheat (Figure 7.5). This axis clearly pulls apart the Bronze Age from the post-Bronze Age assemblages. Singular exceptions are associated to records corresponding to single crop stores (e.g., Ortaköy, Late Bronze Age, Oybak Dönmez 2019), atypical depositional contexts (e.g., Büklükale, Middle Bronze Age, Fairbairn et al. 2019), and assemblages based on a limited number of samples (e.g., Kaman-Kaleöyük, Middle Bronze Age, Nesbitt 1993). The second axis of the plot, explaining the 21% of the variance, correlates with the contribution of barley (*Hordeum vulgare*, positive values), which is in turn negatively correlated with grape (*Vitis vinifera*) and fig (*Ficus carica*). Rather than expressing a chronological trend, this axis could be interpreted in terms of dry (positive values) versus moist-demanding (negative values) assemblages, with the latter being characterized by a lower contribution of barley coupled by an emphasis on the cultivation of more water demanding crops – such as orchard taxa, free-threshing wheat, and einkorn (Figure 7.5) (Riehl 2009). Confirming the considerations that I have previous made at the supraregional scale, also in central Anatolia millets correlate with post-Bronze Age records. The aforementioned presence of local and regional differences within central Anatolia is corroborated by the tendency of assemblages originating from different levels of the same multiperiod site to cluster in the multivariate space – e.g., Küllüoba, Boğazköy, Gordion, and Kınık Höyük (Figure 7.5). These observations can hint to the presence within the Anatolian Plateau of local long-term agricultural traditions, an aspect that I will further discuss elsewhere in this chapter.

7.2.2 *Arboriculture and land use changes: the Beyşehir Occupation Phase*

In the following paragraphs, I will briefly discuss the main trends in land use change documented in palynological records. For a general introduction to pollen analysis, I refer to Section 2.2. Given space and time limits, I will limit this overview to the most macroscopic palynological phenomenon in Late Holocene Anatolia: the so-called "Beyşehir Occupation Phase". I have already discussed this regional palynological phase in Chapter 5, in relation to the wood charcoal record from Niğde-Kınık Höyük (Section 5.5).

The "Beyşehir Occupation Phase" (hereafter BOP) is a regional phase of forest clearance and agricultural expansion, which is abundantly documented in several Late Holocene pollen sequences from the Anatolian Peninsula (van Zeist et al. 1975, Bottema et al. 1986, 1990, Eastwood et al. 1998, Roberts 2018, Woodbridge et al. 2019). In pollen records, the BOP is consistently defined by: (*i*) an abrupt decline in arboreal pollen, which suggests a contraction in forest cover; (*ii*) an increase of cereal-type pollen and of other anthropogenic indicators; and (*iii*) the occurrence and increased attestation of pollen of fruit crops – such as olive (*Olea europaea*), walnut (*Juglans regia*), manna ash (*Fraxinus ornus*), chestnut (*Castanea sativa*), Pistachio (*Pistacia* sp.), and grapevine (*Vitis vinifera*) (Figure 7.6). Given this general range of taxa, different sites show particular emphasis towards specific arboreal crops (e.g., Eastwood et al. 1998, Roberts 2018, Şenkul et al. 2022).

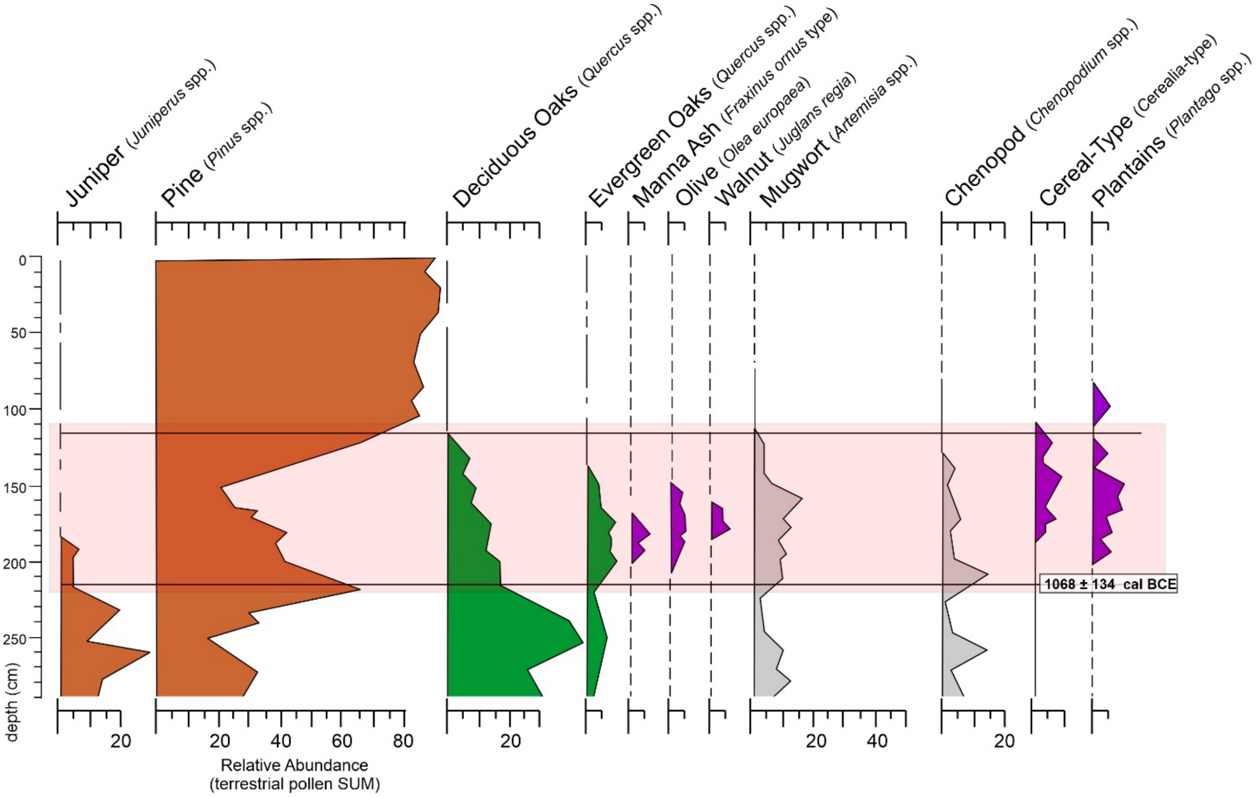


Figure 7.6 – *Late Holocene pollen sequence from Söğüt, the BOP is indicated in red* (*redrawn from* *van Zeist et al. 1975*).

This Late Holocene phase of land-use change was first documented as part of the pioneering research conducted in southwestern Anatolia by Willem van Zeist and collaborators (see Section 2.2.2), most notably at Söğüt (Figure 7.6) and Lake Beyşehir – the latter soon becoming the type-site for this phase (van Zeist et al. 1975, Roberts 2018: 53). Subsequent research detected similar palynological trends in several other southwestern Anatolian Late Holocene pollen sequences (Bottema et al. 1986, 1990), which suggests the presence of a regionally coherent phase of agricultural expansion and forest clearances (Eastwood et al. 1998). In addition to southwestern Anatolia, pollen records from south-central, northern, and western Anatolia (Figure 7.7), as well as from Cyprus and the Levantine coast, clearly indicates the supraregional scale of this phenomenon (Roberts 2018).

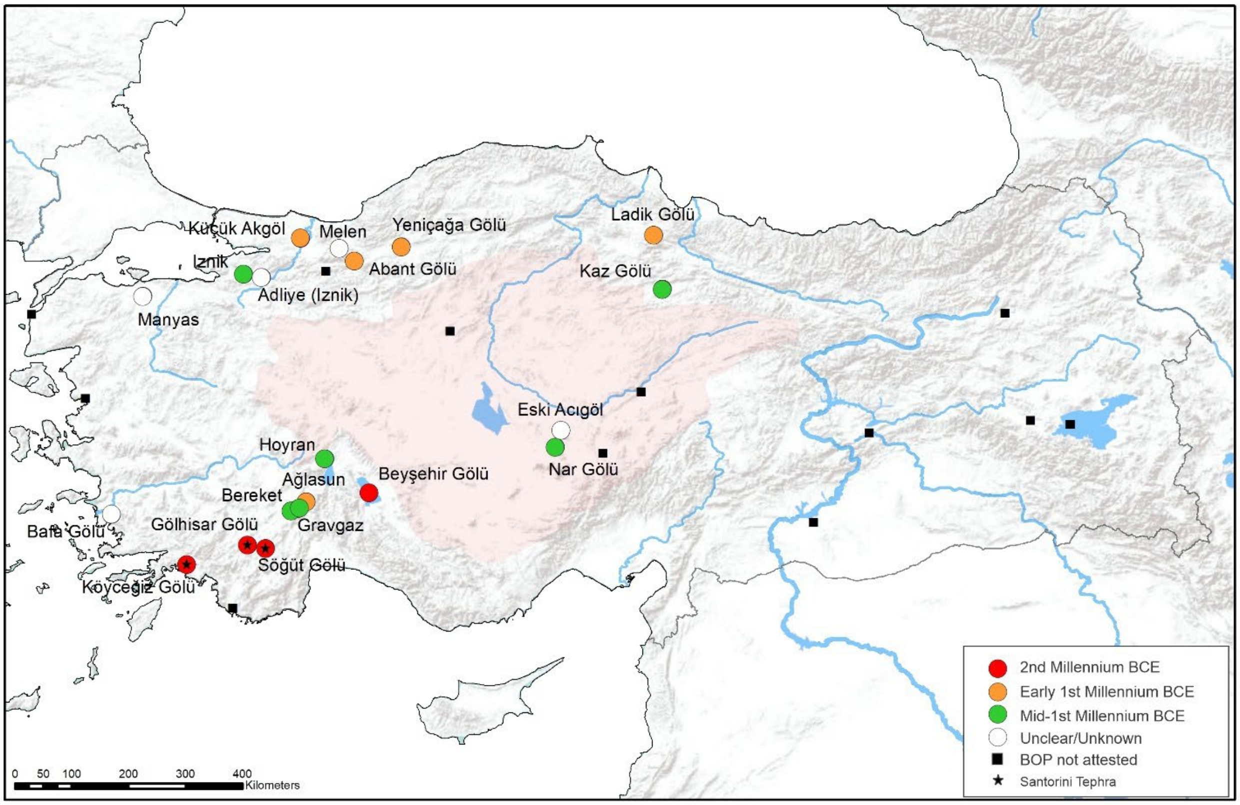

Küçük Akgöl
Melen
Yeniçağa Gölü
Ladik Gölü
Iznik
Abant Gölü
Kaz Gölü
Adliye (Iznik)
Manyas
Eski Acıgöl
Hoyran
Nar Gölü
Ağlasun
Beyşehir Gölü
Bereket
Gravgaz
Bafa Gölü
Gölhisar Gölü
Söğüt Gölü
Köyceğiz Gölü
0 50 100 200 300 400 Kilometers
2nd Millennium BCE
Early 1st Millennium BCE
Mid-1st Millennium BCE
Unclear/Unknown
BOP not attested
Santorini Tephra

Figure 7.7 – *Late Holocene radiocarbon dated pollen sequences (see* Section 2.2*). The sites where the BOP is attested are located. The chronology for the beginning of the BOP follows* Roberts 2018.

The chronology of the BOP has been most recently reviewed by Roberts (2018). The author recognized the presence of a time-transgressive beginning of this phase: (*i*) in the Middle/Late Bronze Age (~ 2nd millennium BCE), (*ii*) in the Early Iron Age (early 1st millennium BCE), and (*iii*) in the Achaemenid and Hellenistic period (second half 1st millennium BCE) (Roberts 2018). The dates of the end of the BOP, which is generally defined by an abrupt disappearance of arboreal crops and an increase in forest tree pollen (especially pine), cluster on a shorter time window, in the mid-1st millennium CE (Roberts 2018). The earliest onset of the BOP is documented at southwestern Anatolia sites: Köyceğiz Gölü, 16th–13th century BCE (van Zeist et al. 1975); Söğüt Gölü, 14th – 10th century BCE (van Zeist et al. 1975); Gölhisar Gölü, 13th – 10th BCE (Eastwood 1997); Beyşehir Gölü, 18th century BCE (van Zeist et al.

1975) (Figure 7.7 and 7.8). In three of these sequences (Köyceğiz, Söğüt, Gölhisar) it has been identified a tephra level associated to the eruption of Santorini, which is currently dated by most scholars (not without a debate) to the late 17th century BCE (Manning et al. 2014). This tephra provides a very solid post-quem term to the beginning of the BOP in southwestern Anatolia. The absolute dating of this palynological phase, nevertheless, remains problematic.

As already noted, the chronology of several pollen sequences are based on single radiocarbon determinations (e.g., Beyşehir Gölü; van Zeist et al. 1975), which are often conducted on bulk samples of organic debris. Dates obtained from bulk materials are commonly dictated by the lack of suitable terrestrial macrofossils. Radiocarbon determinations of bulk samples from limnic deposits are known to potentially return dates older than their actual depositional age of the sediment, chiefly due to the presence of aquatic organisms affected by radiocarbon reservoir effect (e.g., Strunk et al. 2020). The introduction of AMS dating mitigated in part these problems, by allowing the dating of smaller amounts of terrestrial macrofossils or concentrations of microfossils (e.g., pollen; see Tunno et al. 2021). These latter techniques were, however, not available at the time of the research conducted by van Zeist and colleagues.

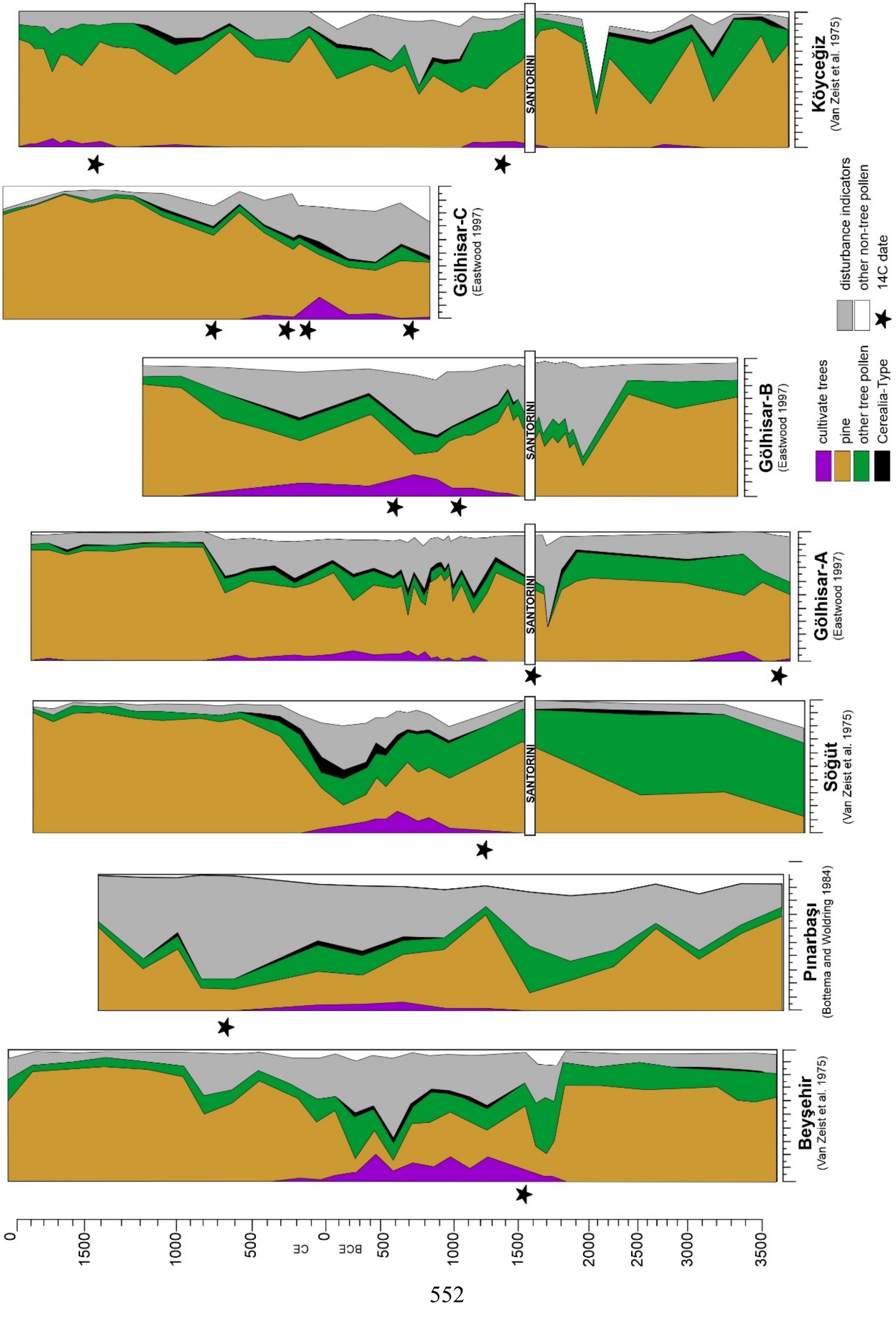
Leaving aside, for the time being, these chronological and methodological issues, the "Beyşehir Occupation Phase" unequivocally documents an important Late Holocene phase of anthropogenic transformation of the landscape, which hallmarks were forest clearances and arboricultural expansion. It is remarkable that several economic taxa, such as *Olea*, during the BOP are attested in amounts that will remain unmatched in later periods, including contemporary spectra and modern pollen rains

(Roberts 2018). This evidence surely requires to be weighed against both strengths and limits of fossil pollen analysis (see Section 2.2.1), more specifically acknowledging the issues of non/under-representation of several important economic plants (Castellano 2021: 25-26) and long-distance deposition of some key pollen types (e.g., *Olea* and *Pinus*) (see Kaniewski et al. 2009, England et al. 2022).

The presence of the BOP has been confirmed by more recent palynological research conducted in southwestern Anatolia and elsewhere in the peninsula – e.g., at Ağlasun (BOP starts in the 10th century BCE, according to Roberts 2018), Bereket (4th century BCE; Kaniwski et al. 2013, Bakker et al. 2013), Gravgaz (4th century BCE; Bekker et al. 2012), and Nar Gölü (5th century BCE; England et al. 2008, Roberts et al. 2016).

I am not aware, however, of attempts to replicate the early research conducted by van Zeist and colleagues (e.g., 1975) at key sites such as Beyşehir, Köyceğiz, and Söğüt. In addition of replicability being a cornerstone in scientific research, new dating techniques (e.g., AMS applied on terrestrial macro- or micro-remains, as previously discussed) and palynological protocols (e.g., coring, subsampling, identifications) would surely allow to better frame this key palynological phase at a finer chronological resolution, both in absolute and relative terms.

(Next page) Figure 7.8 – *Summary percentage pollen diagrams for selected sites in southwestern Anatolia. The location of the Santorini Tephra Layer is reported, if detected in the sequence. Redrawn from Eastwood et al. 1998. For chronological basis and further explanation see Eastwood et al. 1998. Radiocarbon dates are reported in Table 2.10, for location of the sites see Figure 7.7. Note the sequence of Pınarbaşı is not reported in Figure 7.7, not meeting the minimum chronological criteria outlined in Section 2.2.2.*


Beyşehir
(Van Zeist et al. 1975)
Pınarbaşı
(Bottema and Woldring 1984)
Söğüt
(Van Zeist et al. 1975)
Gölhisar-A
(Eastwood 1997)
Gölhisar-B
(Eastwood 1997)
Gölhisar-C
(Eastwood 1997)
Köyceğiz
(Van Zeist et al. 1975)
SANTORINI
0
1500
1000
500
CE
0
BCE
500
1000
1500
2000
2500
3000
3500
cultivate trees
pine
other tree pollen
Cerealia-Type
disturbance indicators
other non-tree pollen
14C date

7.3 Early Bronze Age (3000-2000 BCE): staples economies and social complexity

Having provided a general overview of the main trends documented in both carpological and palynological records, I will now move to an analysis of the single chronological periods covered by the dissertation project. For each period, I will first provide an overview of the published archaeobotanical (seeds and fruits) evidence, to which follows a discussion of a selection of central topics on agricultural production in the broader socio-cultural and historical context.

The Early Bronze Age (EBA) is generally associated in the literature to the emergence of social complexity in Asia Minor, as evidenced by the attestation of the first fortified urban sites, social stratification, metallurgy, and long-distance trade networks (Section 1.2.1). Which agricultural landscape was associated to these processes?

7.3.1 - *The Early Bronze Age archaeobotanical record: an overview*

The archaeobotanical evidence dating to the Early Bronze Age is summarized in Table 7.2. The cereal record is graphically presented in Figure 7.9, pulses and oilseeds in Figure 7.10, and fruits-nuts in Figure 7.11. The methodology used in these elaborations has been outlined in Section 7.1. Archaeobotanical assemblages have been organized based on the tripartite subdivision of the Early Bronze Age: EBA I, ca. 3000-2700/2600 BCE; EBA II, ca. 2700/2600-2300 BCE; EBA III, ca. 2300-2000 BCE. For sites locations and research history, I refer to Section 2.1.3.

(Next page) Table 7.2 – *EBA archaeobotanical sequences, for references see Section 2.1.3 and Appendix 1. If the sum of the specimens in a given group (cereals, pulses, etc.) exceed the cutoff value of 100, data are provided as relative abundances calculated using the group total as sum. On the contrary, abundances are reported using a semi-quantitative scale (*= 1, += 2 to 9, ++= 10 to 24, +++= 25 to 49, ++++= >49).*

	Period	Samples	NISP	**Cereals**	Barley (*Hordeum vulgare*)	Naked Barley (*Hordeum vulgare var. nudum*)	Einkorn (*Triticum monococcum*)	Emmer (*Triticum dicoccum*)	Einkorn/Emmer (*T. monococcum/dicoccum*)	Free-Threshing Wheat (*Triticum aestivum/durum*)	Rye (*Secale cereale*)	Oat (*Avena* sp.)	Broomcorn Millet (*Panicum miliaceaum*)	**Pulses**	Lentil (*Lens culinaris*)	Bitter Vetch (*Vicia ervilia*)	Fava Bean (*Vicia faba*)	Chickpea (*Cicer arietinum*)	Pea (*Pisum sativum*)	Field Peas (*Lathyrus* sp.)	**Fruits and Nuts**	Grape (*Vitis vinifera*)	Fig (*Ficus carica*)	Olive (*Olea europaea*)
Central Anatolia																								
Çadır Höyük	CH/EBA I	10	287		97%		1%	1%		<1%					+++	++			+					
Küllüoba	EBA I	3	7505		21%		45%	9%	1%	24%					47%	47%	1%			5%		+		
Küllüoba	EBA II	56	322707		4%		88%	5%	<1%	2%					1%	98%	<1%	<1%	<1%	<1%		+		
Küllüoba	EBA III	42	5769		17%		40%	29%	1%	16%					36%	57%	1%	2%	1%	3%		+		
Demircihüyük	EBA II	6	566		41%		27%	21%	8%	3%					++	+++		+						
Kültepe	EBA III	4	1128		36%				42%	22%					+++	++++						+		
Eastern Anatolia																								
Sos Höyük (Vb-c)	EBA I/II	17	562		70%			2%		28%			1%		++	*				*				
Sos Höyük (Vd)	EBA II/III	8	442		52%			3%		45%						*				*				
Sos Höyük (IVa)	EBA III	8	150		51%			5%		45%					*				+					
Arslantepe (VIb)	EBA I	>199	132188.5		60%		14%	23%		3%		<1%			1%		<1%	33%	66%			1%		
Arslantepe (VIc)	EBA II	30	13083.5		95%			<1%		5%					<1%			99%	<1%			+		
Aşvan-Taşkun Mevkii	EBA I	12	53282		89%	<1%	<1%	3%		7%	<1%				++	+		*	++			++		
Aşvan-Aşvan Kale	EBA I/II	11	3863		12%					88%					+	*						++		
Korucutepe	EBA II	10	3380.28		49%	<1%		31%		19%					30%			70%				++		
İmanoğlu Höyük	EBA III	5	10439		100%										<1%				100%					
Southeastern Anatolia																								
Mezraa Höyük	EBA I	5	227		90%		1%	6%		4%					++	*				+		+		
Mezraa Höyük	EBA II/III	5	49		++					++					+					+		+		
Ziyaret Tepe	EBA II/III	17	1338		98%		<1%	1%		<1%					++			+	+	*		++	+	
Titriş Höyük	EBA III	32	2170		68%		3%	17%	11%	2%					18%	32%		<1%		50%		76%	2%	7%
Gre Virike	EBA I/II/III	13	1280		86%			14%		<1%					++					+		++++		+
Tilbaşar Höyük	EBA I/II/III	37	1444		94%		3%	3%				<1%			94%			1%	2%	4%		4%		94%
Mediterranean																								
Mersin-Yümüktepe	EBA II/III	nn	110		+		*	++		+		++			+	+						+++		+++
Tell Tayinat (FP8-7)	EBA III	63	893		51%		1%	19%		28%					9%		4%		5%			66%	10%	24%
Aegean																								
Troy (Troia I)	EBA I	12	214		++		++	+++	+	*						+				+		9%	91%	
Troy (Troia II)	EBA II	6	230		+		+	+	+	*					+	+	*			+		23%	74%	2%
Troy (Troia IV)	EBA III	25	129895		91%		5%	3%	1%	<1%					<1%	1%	<1%		98%	<1%		42%	55%	
Çukuriçi Höyük (IV-III)	EBA I	43	133		+		+	*							+	+				*		31%	64%	
Yenibademli Höyük	EBA I/II	15	2132087215		88%		<1%	12%							<1%	2%	90%		5%	2%		++		
Liman Tepe	EBA I	8	617		24%		22%	44%	3%	7%					62%	29%			2%	6%		+++	+++	
Liman Tepe	EBA II	2	19		+		+	+								*						+		
Bakla Tepe	EBA I/II/III	6	49		+		++	+++							+							*	*	
Black Sea																								
Ikiztepe	EBA I	17	1390		17%		1%	79%		3%					22%	74%			4%	<1%		13%	81%	
Ikiztepe	EBII	9	210		40%		4%	40%		16%					+	+				*		+	+	
Ikiztepe	EBIII	12	193		44%			50%		6%					+	+			+	*		*	+	
Oymaağaç	EBA I/II/III	16	90		+		++	++	+	+					+					+				+++

	Period	Almonds (*Amygdalus* sp.)	Plums-genus (*Prunus* sp.)	Pear/Apple (*Pyrus/Malus*)	Cotoneaster (*Cotoneaster* sp.)	Hawthorn (*Crataegus* sp.)	Mountain Ash (*Sorbus* sp.)	Rose (*Rosa* sp.)	Hackberry (*Celtis* sp.)	Hezelnut (*Corylus* sp.)	Pine (*Pinus* sp.)	Pistachio (*Pistacia* sp.)	Oak (*Quercus* sp.)	Brambles (*Rubus* sp.)	Elderberry (*Sambucus* sp.)	**Oilseeds and varia**	Flax (*Linum usitatissimum*)	Gold-of-Pleasure (*Camelina sativa*)	Safflower (*Carthamus tinctorious*)
Central Anatolia																			
Çadır Höyük	CH/EBA I																+		
Küllüoba	EBA I																	98%	2%
Küllüoba	EBA II																	96%	4%
Küllüoba	EBA III																	84%	16%
Demircihüyük	EBA II																		
Kültepe	EBA III																*		
Eastern Anatolia																			
Sos Höyük (Vb-c)	EBA I/II																		
Sos Höyük (Vd)	EBA II/III																		
Sos Höyük (IVa)	EBA III																		
Arslantepe (VIb)	EBA I	<1%			88%	<1%	6%	5%											
Arslantepe (VIc)	EBA II																		
Aşvan-Taşkun Mevkii	EBA I											+++					*		
Aşvan-Aşvan Kale	EBA I/II					*			+										
Korucutepe	EBA II																		
İmanoğlu Höyük	EBA III																		
Southeastern Anatolia																			
Mezraa Höyük	EBA I																		
Mezraa Höyük	EBA II/III																		
Ziyaret Tepe	EBA II/III																+		
Titriş Höyük	EBA III		2%			6%				<1%		6%	1%						
Gre Virike	EBA I/II/III																		
Tilbaşar Höyük	EBA I/II/III		1%																
Mediterranean																			
Mersin-Yümüktepe	EBA II/III		*									*							
Tell Tayinat (FP8-7)	EBA III											<1%					+		
Aegean																			
Troy (Troia I)	EBA I																		
Troy (Troia II)	EBA II																		
Troy (Troia IV)	EBA III			1%				1%			1%						100%	<1%	
Çukuriçi Höyük (IV-III)	EBA I	5%																	
Yenibademli Höyük	EBA I/II																		
Liman Tepe	EBA I																		
Liman Tepe	EBA II																		
Bakla Tepe	EBA I/II/III																		
Black Sea																			
Ikiztepe	EBA I		<1%			1%				<1%			<1%	4%	<1%		*		
Ikiztepe	EBII				++	+				+				+++			+		
Ikiztepe	EBIII				+	+				*				*			+		
Oymaağaç	EBA I/II/III								+								+		

- *Cereal assemblages*

Four archaeobotanical assemblages published with quantitative data are available from EBA central Anatolia: Çadır Höyük, dating to the Late Chalcolithic/EBA I transition (von Baeyer et al. 2021); Demircihöyük, dating to the EBA II (Schlichtherle 1977); Kültepe, dating to the EBA III (Fairbairn et al. 2013, Fairbairn 2014); and Küllüoba, spanning the entire 3rd millennium BCE (Çizer 2015). Cereal farming during the EBA in central Anatolia was centered on cultivation of hulled two-row barley and hulled wheats (einkorn and emmer). Rachis and grains remains indicate that free-threshing wheat was already a component of the agricultural landscape, although of comparatively secondary importance (Figure 7.9).

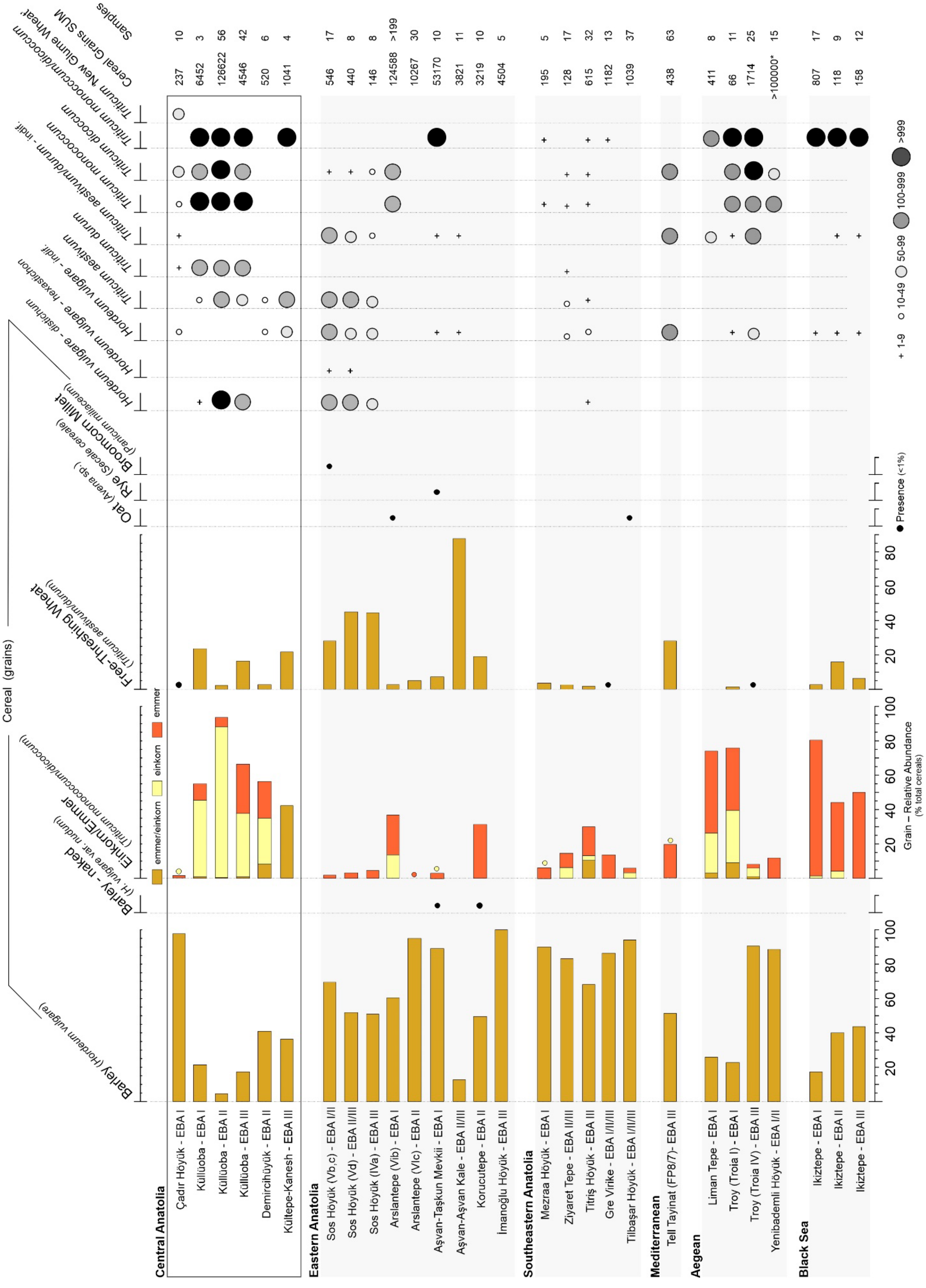
At Demircihöyük and Küllüoba, located in western sector of central Anatolia, hulled wheats appear to have been favored over barley, with a particular emphasis on the cultivation of einkorn (*Triticum monococcum*). Free-threshing wheat is attested; with rachis remains from Küllüoba supporting the presence of macaroni wheat (*T. durum* s.l.). The occurrence of the latter is somehow surprising, given the otherwise preponderance throughout Anatolian history of hexaploid forms (bread wheat, *T. aestivum* s.l.) (e.g., Fairbairn 2021: 220). Bread wheat could have been favored at most Anatolian sites, except EBA Küllüoba, due to a higher frost tolerance (Brouwer 1972), which is more suited to the central Anatolian continental climate (Section 1.1).

The cereal record from Çadır Höyük, in north central Anatolia, is characterized by a predominance of barley (Figure 7.9). Compared to wheat, domesticated barley is more tolerant to aridity (Riehl 2019: 3). It would be, thus, tempting to correlate its importance at Çadır Höyük to more arid climatic conditions, possibly exacerbated in the aftermath of the so called 5.2k BP climatic event (von Baeyer et al. 2021). Lacking other early 3rd millennium BCE published archaeobotanical sequences from the region and given the relative limited number of samples dating to this period from Çadır Höyük, this hypothesis remains speculative. It should be, furthermore, noted the presence at Çadır Höyük of rachis fragments identified as 'New Glume Wheat' (*Triticum timopheevii* group) (Figure 7.9), a crop which will afterwards disappear from the Anatolian archaeobotanical record.

If we compare the evidence from central Plateau to the other Anatolia regions, interesting trends come to light. A comparatively consistent regional patter in cereal cultivations emerges, which would appear to support the presence of distinct agricultural regimes, defined by specific emphasis on the cultivation of some cereals over others. As I will discuss later, this observation is further corroborated by the quantitative attestation of pulses and fruits-nuts taxa.

Eastern Anatolia is characterized by a preference for the cultivation of free-threshing wheat, based on rachis remains from Sos Höyük most likely hexaploid (Bread wheat group, *Triticum aestivum* s.l.) (Figure 7.9). The latter site, located near Erzurum, stands out for the overwhelmingly dominance of free-threshing over hulled wheat, with only single occurrences of emmer and a complete absence of einkorn (Figure 7.9). More to the southwest, in the Middle-Upper Euphrates Valley, distinct cereal assemblages are documented at Arslantepe and Korucutepe, both sites characterized by a greater contribution of emmer (Figure 7.9).

(Next page) Figure 7.9 – *EBA: cereals. The graph is based on relative abundance calculated using the total of selected cereal grains as sum. Chaff is reported using a semi-quantitative scale. For details see* Section *7.1. Only assemblages with more than 50 cereal grains are included in the figure.*


Cereal (grains)
Barley (Hordeum vulgare)
Barley - naked (H. vulgare var. nudum)
Einkorn/Emmer (Triticum monococcum/dicoccum)
emmer/einkorn
einkorn
emmer
Free-Threshing Wheat (Triticum aestivum/durum)
Oat (Avena sp.)
Rye (Secale cereale)
Broomcorn Millet (Panicum miliaceum)
Hordeum vulgare
Hordeum vulgare - distichum
Hordeum vulgare - hexastichon
Triticum vulgare - indif.
Triticum aestivum
Triticum durum
Triticum aestivum/durum - indif.
Triticum monococcum
Triticum dicoccum
Triticum monococcum/dicoccum
Triticum 'New Glume Wheat'
Cereal Grains SUM
Samples
Central Anatolia
Çadır Höyük - EBA I 237 10
Küllüoba - EBA I 6452 3
Küllüoba - EBA II 126622 56
Küllüoba - EBA III 4546 42
Demircihüyük - EBA II 520 6
Kültepe-Kanesh - EBA III 1041 4
Eastern Anatolia
Sos Höyük (Vb,c) - EBA I/II 546 17
Sos Höyük (Vd) - EBA II/III 440 8
Sos Höyük (IVa) - EBA III 146 8
Arslantepe (VIb) - EBA I 124588 >199
Arslantepe (VIc) - EBA II 10267 30
Aşvan-Taşkun Mevkii - EBA I 53170 10
Aşvan-Aşvan Kale - EBA II/III 3821 11
Korucutepe - EBA II 3219 10
İmanoğlu Höyük - EBA III 4504 5
Southeastern Anatolia
Mezraa Höyük - EBA I 195 5
Ziyaret Tepe - EBA II/III 128 17
Titriş Höyük - EBA III 615 32
Gre Virike - EBA I/II/III 1182 13
Tilbaşar Höyük - EBA I/II/III 1039 37
Mediterranean
Tell Tayinat (FP8/7)- EBA III 438 63
Aegean
Liman Tepe - EBA I 411 8
Troy (Troia I) - EBA I 66 11
Troy (Troia IV) - EBA III 1714 25
Yenibademli Höyük - EBA I/II >100000* 15
Black Sea
Ikiztepe - EBA I 807 17
Ikiztepe - EBA II 118 9
Ikiztepe - EBA III 158 12
20 40 60 80 100
20 40 60 80 100
20 40 60 80
Grain – Relative Abundance (% total cereals)
● Presence (<1%)
+ 1-9
○ 10-49
○ 50-99
● 100-999
● >999

Assemblages from southeastern Anatolian are characterized by a systematic secondary role played by wheat: free-threshing wheat is attested only in single grains, and both einkorn and emmer are of minor importance in comparison to barley. The centrality of barley in southeastern Anatolia could have been to some degree promoted by local environmental conditions, with barley (as already noted) more suitable for cultivation under drier climatic conditions and on soils affected by salinization (Riehl 2019: 3). The centrality of barley in southeastern Anatolian farming will remain characteristic of the region throughout the entire chronological period here considered, with only single exceptions generally associated to single caches of wheat.

The late 3rd millennium BCE sequence from Tell Tayinat, in the Amuq Valley, is the only EBA archaeobotanical record available from the Mediterranean region (Section 2.1.3). The cereal assemblage from this site is characterized by an approximately equal contribution of emmer and free-threshing wheat, with hulled barley predominant in the record (Figure 7.9). Einkorn, on the contrary, is only sporadically attested.

Free-threshing wheat appears to have played a minor role in the Aegean coast, where especially in the EBA I (Troy I and Liman Tepe), einkorn and emmer are the predominant staples (Figure 7.9). The increased importance of barley at EBA III Troy (Troia IV) and EBA I/II Yenibademli Höyük is of difficult interpretation. Pending more evidence, it remains unclear whether this trend is indicative of an actual change in Aegean cereal farming preferences or if it reflects limited sampling.

In the Black Sea, quantitatively published EBA archaeobotanical records are available from Ikiztepe and Oymaağaç (Section 2.1.3). The latter site has been excluded from the analysis of cereals, due to very low specimen counts (<50 grains, see Section 7.1). The assemblage from Ikiztepe, throughout the entire 3rd millennium BCE, is characterized by a predominance of emmer, with both einkorn and free-threshing wheat apparently playing a secondary role in local cereal farming (Figure 7.9).

- *Pulse and oilseeds*

The EBA record for pulses and oilseeds is presented in Figure 7.10. Lentil and bitter vetch are by far the most ubiquitous and abundantly attested pulses in EBA sites in central Anatolia sites, a trend which will remain in place also during the following periods. Other pulses are only sporadically documented, which would suggest either their minor economic role (e.g., chickpea and pea) or their possible occurrence as weeds (e.g., field pea) (Figure 7.10). As already noted in Section 7.2.1, the centrality in central Anatolian farming of lentil and bitter vetch could be likely connected to their lower moisture requirements (Marston and Castellano 2021). Among oilseeds, it should be noted the attestation at Küllüoba throughout the entire 3rd millennium BCE of gold-of-pleasure (*Camelina sativa*) and Safflower (*Carthamus tinctorious*), two plants that could have been potentially cultivated as oil sources (Figure 7.10).

A greater taxonomic diversity in the pulse record is attested in archaeobotanical assemblages from other regions of the Anatolian Peninsula. The comparatively frequent occurrence of single caches of pulses limits the possibility to extrapolate coherent regional reconstructions. On the other end, the presence of stores unequivocally testify the cultivation status of a specific taxon at a given site – i.e., chickpea at EBA II Arslantepe, pea at EBA III İmamoğlu, in the Euphrates Valley; and fava bean at EBA III Yenibademli, on the Aegean coast (Figure 7.10).

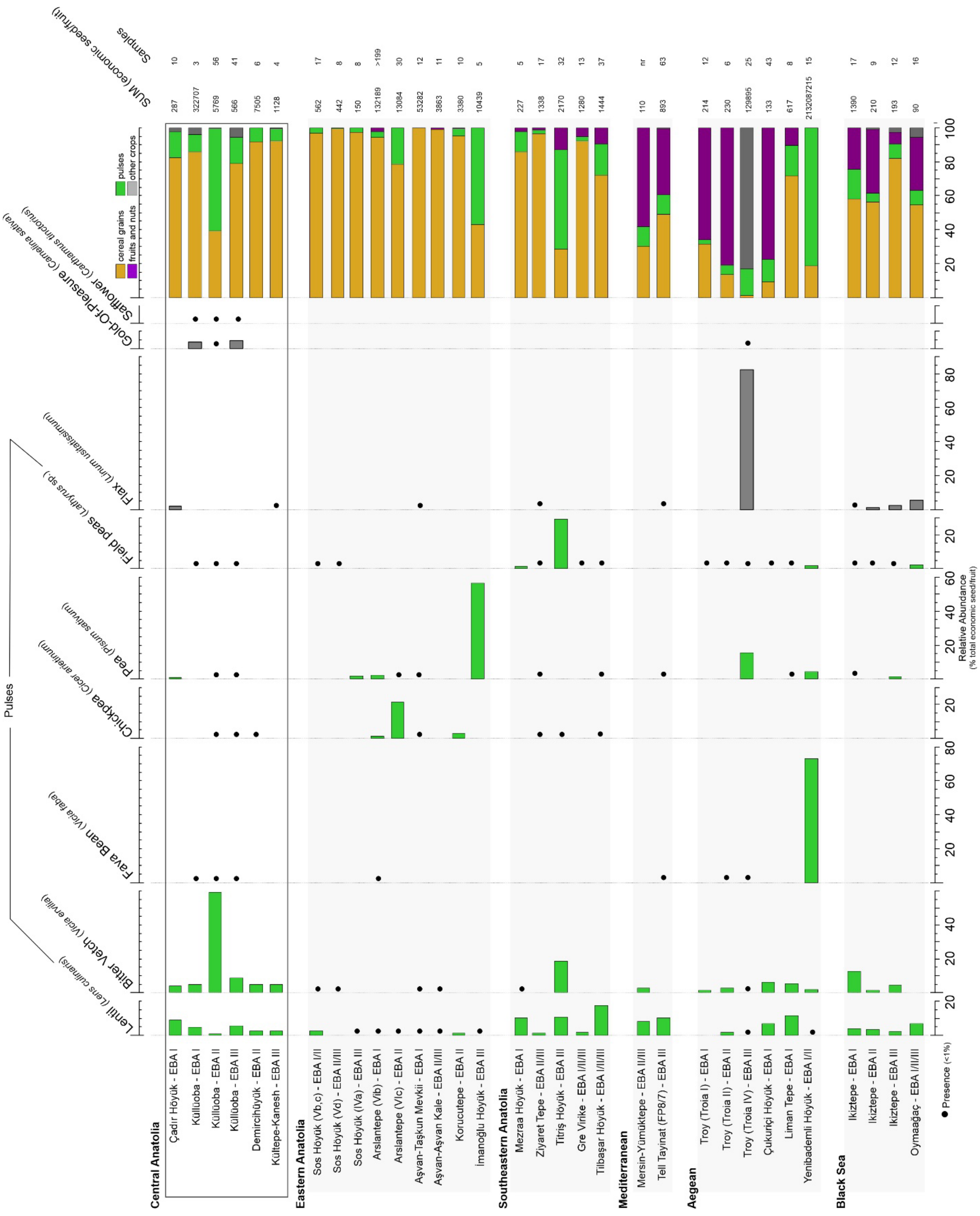


Figure 7.10 – *Early Bronze Age: pulses and oilseeds. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum (see* Section 7.1*). Only assemblages with more than 50 selected economic seed/fruit remains are included in the figure.*

I should also note the attestation of a cache of field pea (*Lathyrus sativus/cicera*) at Titriş Höyük, in southeastern Anatolia (Figure 7.10). This occurrence might hint to the cultivated status of this pulse, an aspect that I have already discussed in Section 7.2.1. To be singled out is, furthermore, a large store of flax brought to light in EBA III levels at Troy (Troia IV), which supports the cultivation of this crop in the region, either as oilseed or fiber crop (Figure 7.10).

- *Fruits and nuts*

Data on fruits and nuts are reported in Figure 7.11. This evidence supports the full establishment of the Mediterranean orcharding tradition (polyculture) by the Early Bronze Age, with abundant archaeobotanical remains of grape, fig, and olive. As already discussed in the overview provided in Section 7.2.1, this trend chronologically matches a more general phenomenon of expansion of arboriculture occurring in the broader eastern Mediterranean region (e.g., Fuller and Stevens 2019). Within this broader trend, qualitative and quantitative regional differences in the fruit assemblages are documented, which are likely to be traced to specific ecological requirements – e.g., in terms of moisture (*Olea*, *Vitis*, and *Ficus*) and frost tolerance (*Olea* and *Ficus*) (Davis 1966-1985). In these regards, evidence of fruit taxa in EBA central Anatolia is limited to singular attestations of grape seeds, at Küllüoba (EBA I, II, and III) and Kültepe (EBA III) (Figure 7.11). Considering that central Anatolia is likely located outside the expected distribution area of wild grapevine (Zohary et al. 2000), this evidence could be interpreted as indicative of the establishment of viticulture on the Plateau. Viticulture appears to have been, however, conducted at a modest scale, given the paucity of remains. It cannot be disregarded a priori the alternative hypothesis of an origin of these specimens from imported grapes or grape products.

Grape macroremains are not attested in the (rich) central Anatolian archaeobotanical record dating to the Pre-Pottery Neolithic and Ceramic Neolithic periods (Marston and Castellano 2021). I assume, therefore, that grapes were not part of the subsistence of the earliest central Anatolian communities of agriculturists, which supports the generally held belief that the region was most likely outside the distribution area of wild grapevine. The Pre-Pottery Neolithic site of Can Hassan III formerly represented an exception, with grape seeds found together with other carpological remains very much atypical in a PPN context – e.g., rye, free-threshing wheat, and walnut (French et al. 1972). A recent sequence of radiocarbon determinations has proven the intrusive nature (Ottoman) of part of the botanical remains previously attributed to the PPN (Fairbairn 2019b), which directly calls into serious question the chronological reliability of the entire assemblage.

During the Chalcolithic period, grape seeds remains particularly rare throughout central Anatolia. In the published literature, the occurrence of *Vitis* is limited the Early Chalcolithic site of Can Hassan I (French 1972). In addition, a single seed fragment from Çadir Höyük has been tentatively identified as grape (cf. *Vitis vinifera*) (von Baeyer 2018). The available evidence suggests, thus, that in the Chalcolithic period grapevine were not yet part of central Anatolia agriculture. In these terms, the aforementioned Early Bronze Age evidence, although limited, suggests that by this period viticulture become a more stable component of central Anatolian farming. From the 3rd millennium onwards, grape seeds are a comparatively ubiquitous component of archaeobotanical assemblages, although always occurring in limited numbers – single exceptions in these regards are the sites of Büklükale (MBA; Section 7.4) and Niğde-Kınık Höyük (1st millennium BCE; Section 7.6 and 7.7).

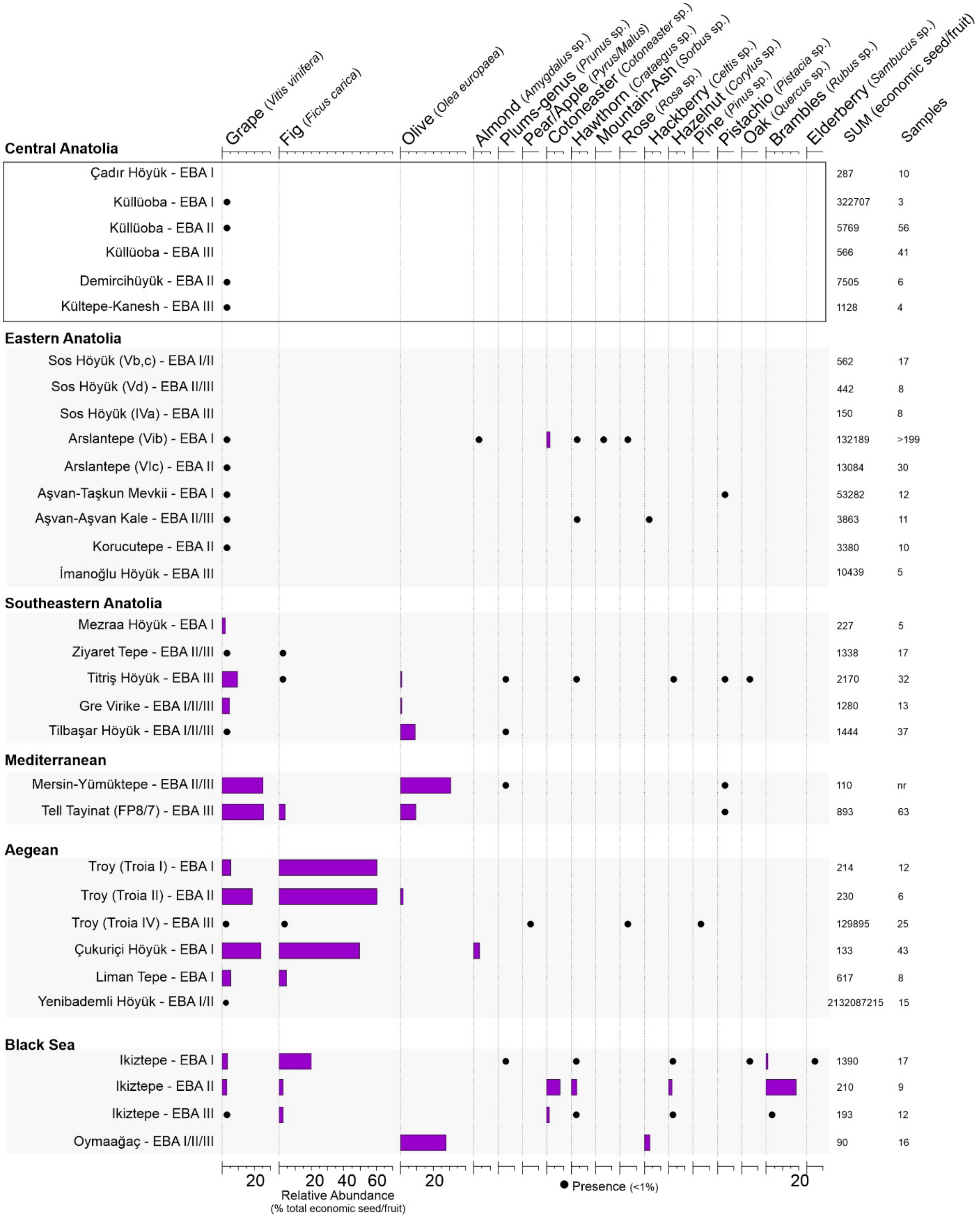


Figure 7.11 – *Early Bronze Age: fruits and nuts. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum (see Section 7.1). Only assemblages with more than 50 selected economic seed/fruit remains are included in the figure.*

In eastern Anatolia, grape seeds are comparatively well-attested at sites located in the Middle-Upper Euphrates Valley (Figure 7.11). In this region *Vitis* seeds are documented as early as the Late Chalcolithic period (Arslantepe, Belisario et al. 1994; Aşvan-Çayboyu, Nesbitt et al. 2017; Korukutepe, van Zeist and Heeres 1974). Viticulture might have, thus, reached the Upper-Middle Euphrates Valley earlier than the central Plateau. I should further note that in the destruction level of Arslantepe Period VIB1 (EBA I) are reported comparatively large caches of seeds/fruits of (common?) cotoneaster (*Cotoneaster* cf. *integerrimus*; Palumbi et al. 2017), mountain ash (*Sorbus* cf. *umbellata*; Palumbi et al. 2017), and rose (*Rosa* sp.; Mir Makhamad 2019). This evidence points to the very likely foraging of these wild fruit trees for their edible products.

A greater importance of viticulture is documented in southeastern Anatolia (Figure 7.11), a region which lies within the expected geographic distribution of wild grapevine (Zohary et al. 2000). The expansion of grapevine cultivation in southeastern Anatolia during the EBA has been already discussed by Miller (2008). Archaeological evidence of structures interpreted in the literature as grape presses/basins (Titriş Höyük, EBA III; Matney et al. 1997: 65, Laneri 2018) corroborates the archaeobotanical record. In addition to grape seeds, and a more sporadic occurrence of fig, olive endocarps are comparatively commonly attested in the region – at Titriş Höyük, Gre Virike, and Tilbaşar Höyük (Figure 7.11).

In sites located in the circum-Mediterranean region, fruit crops are documented at a completely different quantitative scale. *Vitis*, *Olea*, and *Ficus* at some sites (Troy I, Troy II, Mersin-Yumuktepe, Çukuriçi Höyük, Tell Tayinat) represent altogether the predominant component of the entire economic plant assemblage (Figure 7.10 and 7.11). Olive macro-remains are more commonly encountered at sites located in the Mediterranean region (Mersin-Yumuktepe and Tell Tayinat), while fig is predominant in the Aegean coast (Troy I, Troy II, Çukuriçi Höyük). Given the limited sampling, it is unclear whether this trend is due to sampling or if it could underlie an actual specialization in these productions as part of a shared arboricultural tradition. On the contrary, grape seeds are abundantly attested across the broader region (Figure 7.11).

Evidence from Ikiztepe and Oymaağaç suggests that the main Mediterranean fruit crops were also part of the EBA agricultural landscape of the Black Sea Region (Figure 7.11). This region is further characterized by a comparatively frequent occurrence of a several other fruit taxa, possibly exploited from the wild – e.g., cotoneaster (*Cotoneaster* sp.), hawthorn (*Crataegus* sp.), hazelnut (*Corylus* sp.), brambles (*Rubus* sp.), and elderberry (*Sambucus* sp.) (Figure 7.11).

- *Multivariate analysis of EBA Anatolian carpological assemblages*

The trends I have described in the previous section are well captured and summarized by the multivariate plot presented in Figure 7.12. With the sole exception of early 3rd millennium Çadır Höyük, central Anatolia appears to have represented a somehow coherent agricultural district, as part of a more generalized geographic clustering of Anatolia assemblages. In the 3rd millennium BCE, different Anatolian regions appear, thus, to have been characterized by distinctive archaeobotanical assemblages, which hints to the possible presence of distinct farming traditions. In the following paragraphs, I will try to connect these local and regional trends to a broader socio-cultural and historical narrative.

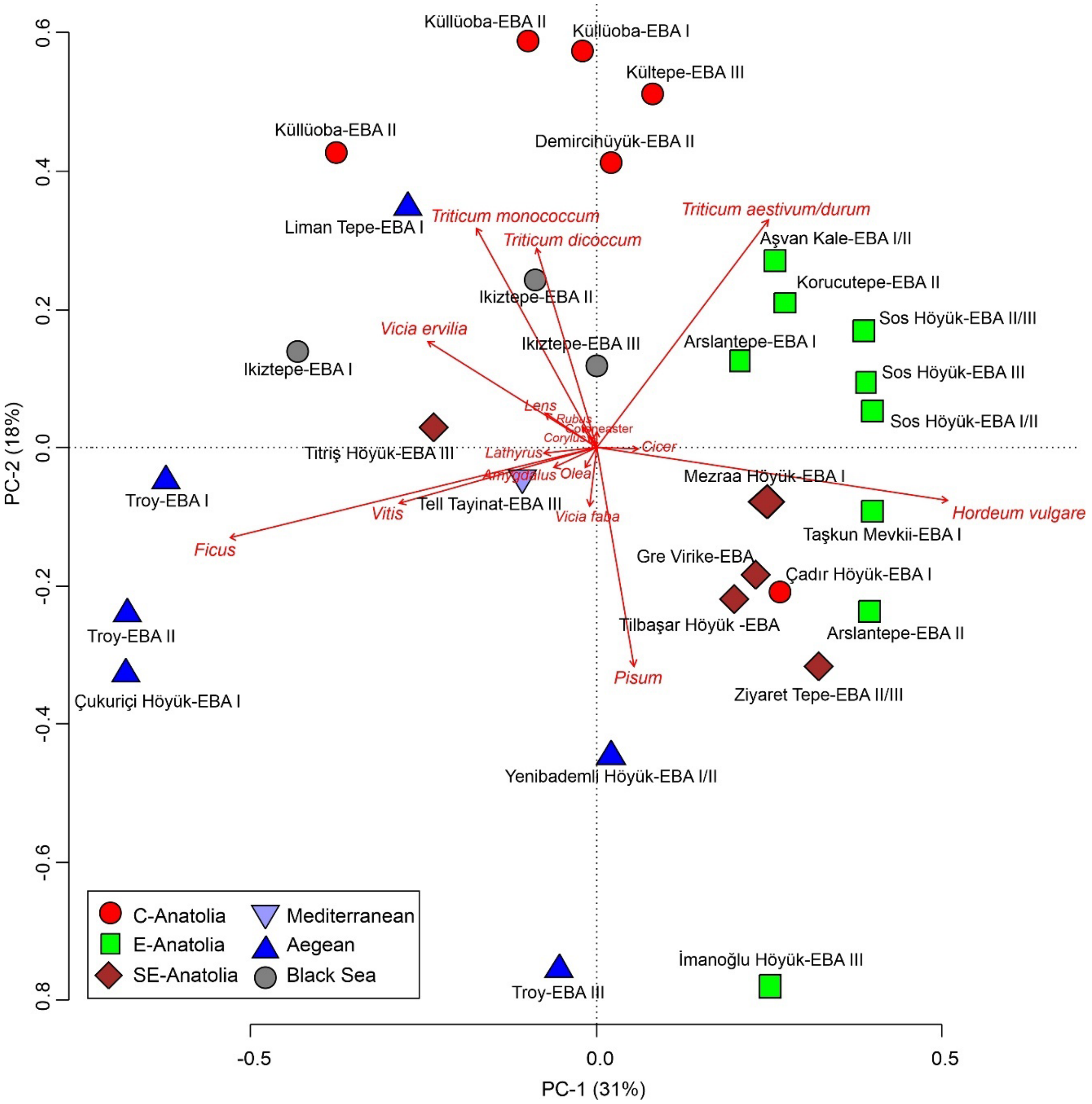


Figure 7.12 – *PCA of Anatolian assemblages dated to the EBA; cereals, pulses and fruits-nuts taxa are included. Small angles between vectors indicate positive correlation, opposite angles negative correlation, right angles lack of correlation. Right-angled projections of a sample on the vector of a taxon approximates the value of that taxon in the sample. Grains identified as* Triticum monococcum/dicoccum *were reassigned based on the ratio between the two crops in the specific assemblage.*

7.3.2 - *Early Bronze Age agriculture: considerations on political economy, elites, and wine*

In the following paragraphs, in the limits of the available space, I will introduce to some of the key issues involving agricultural production and management in the broader socio-cultural context of

3rd millennium BCE Anatolia. These considerations will be extended to the entire Asia Minor peninsula, given the limited archaeological and archaeobotanical datasets more specifically available from the central Plateau.

As noted in Section 1.2.1, the Early Bronze Age is traditionally associated in Anatolia to the emergence of complex societies (Efe 2007, Düring 2012: 257-299, Bachhuber 2009 and 2014, Bintliff 2016, Frangipane 2018a). In the archaeological record, remarkably rich burial contexts (the so-called "royal tombs') and hoards (the so-called 'treasures') are the two most visible phenomena which unequivocally point to presence of pre-eminent individuals in EBA Anatolian societies (Bachhuber 2009). These new established local elites were centered in fortified citadels (Düring 2011, Bachhuber 2014), which could have represented competitive foci in the emerging political landscape. These processes of social stratification appears to have reached full maturation by the EBA II (ca. 2700/2600-2300 BCE), as most notably evidenced in the urban layout and rich archaeological contexts of the second settlement of Troy (Troia II) (e.g., Bintliff 2016).

The source of the political and economic power of these newly established elites is a topic debated in the literature. Although this complex issue cannot be adequately surveyed in the limits of this chapter, it is nevertheless regarded useful to briefly review the implications having a more direct repercussion to our understanding of Anatolian agricultural systems. Agriculture production and staples management are, in fact, at the center of the most influential models explaining more in general the emergence of social complexity – from Gordon Childe's 'Urban Revolution' (1950) to Collin Renfrew's 'Mediterranean Polyculture' hypothesis (1972).

In western Asia scholarship, the narratives on the emergence of social complexity emphasize the role played by cereal production, accumulation, and redistribution (e.g., Childe 1950, Wittfogel 1957, Adams 1981, Algaze 1993, Stein 1994, Frangipane 1996, 2007, 2018a, 2018b, Smith 2004, Pollock 2012, Furholt et al 2020). In order to properly introduce this topic, a brief discussion of the notions of storage and surplus is thus needed.

The cultivation of cereals, and more in general of annual dry crops, implies by definition the presence of some forms of storage: harvest is seasonal, while consumption occurs throughout the entire year (or most of it). It follows that the harvest is expected to exceed the immediate needs, producing what is commonly referred as an agricultural surplus (e.g., Risch 2016, Harstorf and Fixhall 2017). Accordingly, the presence of a surplus could be regarded as a common feature across different agricultural systems. The main question, thus, concerns the intended uses of the exceeding production, which could be hypothetically located on a continuum having food security (surplus as food reserves) and investment (surplus for wealth creation) at the two extremes. By expanding on these considerations, Marcella Frangipane (e.g., 1996, 2007, 2018a, 2018b) has argued for the presence of different regional traditions in agricultural production and surplus management across western Asia, which eventually resulted in different pathways to the emergence of social complexity and early state-like polities. In the following paragraphs, which are drawn on Frangipane research, I will briefly outline these different trajectories.

A form of collective storage has been proposed by the author as distinctive of Neolithic and Early Chalcolithic villages in northern Mesopotamia (Frangipane 2007). The two hallmarks of this system were the presence of large storage buildings and of rudimentary administrative tools, the latter aimed at inspecting and recording individual transactions –i.e., the grains deposited and withdrawn from the stores (Frangipane 2016). This tradition is well documented in the 'Burnt Village' of Tell Sabi Abyad (first half of the 7th millennium BCE) (Akkermans and Duistermaat 1996). At Sabi Abyad, large store buildings are located in a settlement without any apparent form of hierarchy in domestic architecture, hinting to the likely presence of an egalitarian social structure (Frangipane 2016). In small rooms within the store buildings, large quantities of clay sealing bearing the impression of numerous different stamp seals were found, possibly reflecting the plurality of actors (i.e., single households) involved in this communal-based form of centralized storage (Akkermans and Duistermaat 1996).

A different trajectory defines the southern Mesopotamian alluvium during the Samarra and Ubaid period (6th and 5th millennia BCE) (Frangipane 1996, 2007, 2018a, 2018b). In this context, domestic architecture seems to indicate that southern societies were based on extended families, which appears to have been characterized by a degree of social hierarchy (Frangipane 2018b). Large grain stores, in a scale comparable to the ones attested in northern Mesopotamia, are to date not documented. Yet, at sites such as Tell el-'Oueili, grid-buildings have been interpreted as granaries (Hout 1991), which comparatively substantial size could suggest the storage of significant quantities of agricultural surpluses by some emerging pre-eminent households (Frangipane 2018b). In short, some families might have started to accumulated wealth in form of agricultural surpluses. The latter could have been generated by access to better land or more efficient technologies, as part of a productive yet infrastructurally demanding (e.g., irrigation and flood control) agricultural landscape (e.g., Adams 1981). According to Frangipane's interpretation (e.g., 2018a, 2018b), this system eventually structured into a full-flagged centralized and redistributive economy: some social groups accumulated surplus, which was in turn ploughed back in exchange for labor and/or for other goods, ultimately leading to political power and to the establishment of the pyramid of social hierarchy. In southern Mesopotamia, cretulae and seals made their appearance only by the end of the Ubaid period (early 4th millennium BCE), possibly representing an adaptation of the northern administrative tradition to the exponentially growing southern Mesopotamian centralized-redistributive economy (Frangipane 1996). According to this model, the sources of wealth and political power in southern Mesopotamia are ultimately connected to staple production and management, as part of an investment-oriented agricultural economy.

Leaving the Mesopotamian lowlands and returning to our study region, how does the Anatolian Peninsula fit this picture? Southeastern Anatolia and the Middle-Upper Euphrates Valley appear to have been directly engaged with the processes occurring in Mesopotamia, which eventually led in these regions to the establishment by the Late Chalcolithic of original forms of centralized and redistributive political economies, most notably documented at Arslantepe during Period VIA (3400-3100 BCE) (Frangipane 2018c). Conversely, a different trajectory is attested in central and western Anatolia, as I will explain below.

In central and western Anatolia, during the Neolithic and Chalcolithic period, crop storage and processing appears to have been conducted within the individual households, lacking any known evidence of either communal or centralized storage (Frangipane 2018b). According to Frangipane (e.g., 2018b), this household-based system remained characteristic of the agricultural economies of these regions also during the Late Chalcolithic and Early Bronze Age. In the model proposed by Frangipane (e.g., 2018b), the economic and political power of western and central Anatolian elites is regarded as disconnected from a direct interference with agricultural production, but it is conversely associated to the accumulation and display of wealth in form of luxury goods and artisan products, most notably metals. Along these lines, the differences in political economies at the formative stages of social complexity between Mesopotamian and Anatolian have been traditionally reduced to a binary opposition between staple and wealth finances (sensu d'Altroy and Earle 1985). Leaving to future research a more detailed analysis, available archaeological evidence from the Anatolian Peninsula might suggest the existence of a more complex and diversified economic landscape.

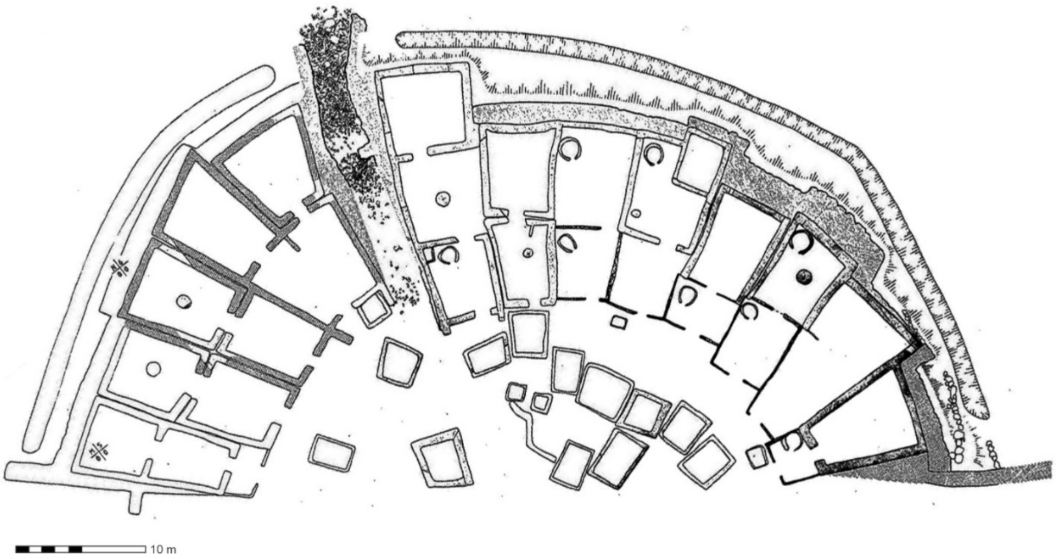


Figure 7.13 – *Demircihüyük (EBA I-II) (after Korfmann 1983)*

The presence of an Early Bronze Age household-based economy could be inferred from the EBA I-II settlement of Demircihüyük (Korfmann 1983). This site is characterized by the presence of small to medium sized (average 5 m^2) storage structures located in a central courtyard, facing the entrance of the single domestic unit – likely one silo corresponded to a single domestic unit (Figure 7.13). A different spatial organization is documented at the contemporary (EBA I-II) village of Karataş, in Lycia. The main building within the so-called 'Central Complex' of Karataş housed storage installations: 12 pits, two of which containing pithoi (Bachhuber 2014: 70-80, and therein references). The evidence from Karataş might support the presence of some forms village-based storage and/or consumption of agricultural products, which according to Bachhuber (2014: 80-82) might have occurred in a socially inclusive rather than elites-restricted setting.

In the more prominent EBA citadels of western and central Anatolia (Düring 2011), which were likely the seats of the emerging elites, there is currently no clear evidence of bulk centralized storage (e.g., large-scale granaries) and redistribution (e.g., mass produced bowl) of agricultural staples (Frangipane 2018b). The attestations of storerooms within representative/administrative buildings (e.g., EBA I-II Küllüoba and Bademağacı, Bachhuber 2014: 130-149; EBA III Seyitömer Höyük, Bilgen et al. 2021: 304; possibly EBA III Kültepe, Kulakoğlu 2017: 220) could reflect the storing of supplies fulfilling the needs of the elite themselves, which in these terms could have functioned as larger-than-usual households. In contrast to this picture, moving to the broader Aegean context, it remains to date unique the evidence from early 3rd millennia ('Blue Period') Poliochni, in the island of Lemnos: a subterranean monumental structure (ca. 19x7 m, more than 3 m deep) which has been tentatively interpreted by the excavator as connected to storing (Bernabò Brea 1964: 186-200). Different form of storages appears, thus, to have been present in western and central Anatolia, possibly reflecting the fluidity and complexity of local and regional trajectories within the 3rd millennium.

The model elaborated by Frangipane, in continuity to an earlier scholarly tradition (e.g., Childe

1950, Wittfogel 1957), emphasizes the importance of productive and management aspects of cereal farming in the processes leading to the establishment of social complexity and political power in Mesopotamia. On the other hand, in the eastern Mediterranean scholarship, the focus has been traditionally on the role played by fruit-growing, as most notably discussed by Collin Renfrew in its seminal 1972 monograph, *The Emergence of Civilization*. The Anatolian Peninsula bridges between these two geographic, cultural, and scholarly regions. It is, thus, useful to briefly discuss this second model.

Renfrew proposed that the Aegean Bronze Age palatial institutions resulted from endogenous processes, which were ultimately connected to two key developments: (*i*) metallurgy, and (*ii*) olive orcharding and viticulture (Renfrew 1972). As far as the second point goes, according to Renfrew's model, the addition of fruit-farming to a cereal-dominated agriculture allowed to maximize production in the ecologically fragmented and diversified Aegean landscape. In other words, marginal lands which were poorly fit for cereals become suitable for fruit-growing cultivation (e.g., olive orcharding and viticulture), which resulted in an increased economic output and in the establishment of local and regional specializations in the production of specific agricultural crops. It is in this context, according to the author, that a redistributive system emerged, in order to facilitate the movement of surpluses between different regions (Renfrew 1972).

This agricultural system, which according to Renfrew played a crucial role in the establishment of Aegean palatial societies, is referred by the author as 'Mediterranean Polyculture'. This model has been criticized on various grounds, including (in comparatively outdated scholarship) the scrutiny of the available archaeobotanical evidence supporting an early 3rd millennium BCE expansion of grape and olive farming across the Aegean region (e.g., Hansen 1988, Hamilakis 1996). Leaving to another context a more detailed discussion of Renfrew's model and of Aegean Bronze Age agriculture, I shall note here that in western Anatolia the Early Bronze Age indeed corresponded to an important expansion in the archaeobotanical attestation of fruit crops (Figure 7.11). If the evidence for grape and fig cultivation is hardly questionable, less straightforward in Anatolia is the record of olive orcharding during the EBA, based on both archaeobotany (Figure 7.11) and palynology (Langgut et al. 2019: 905).

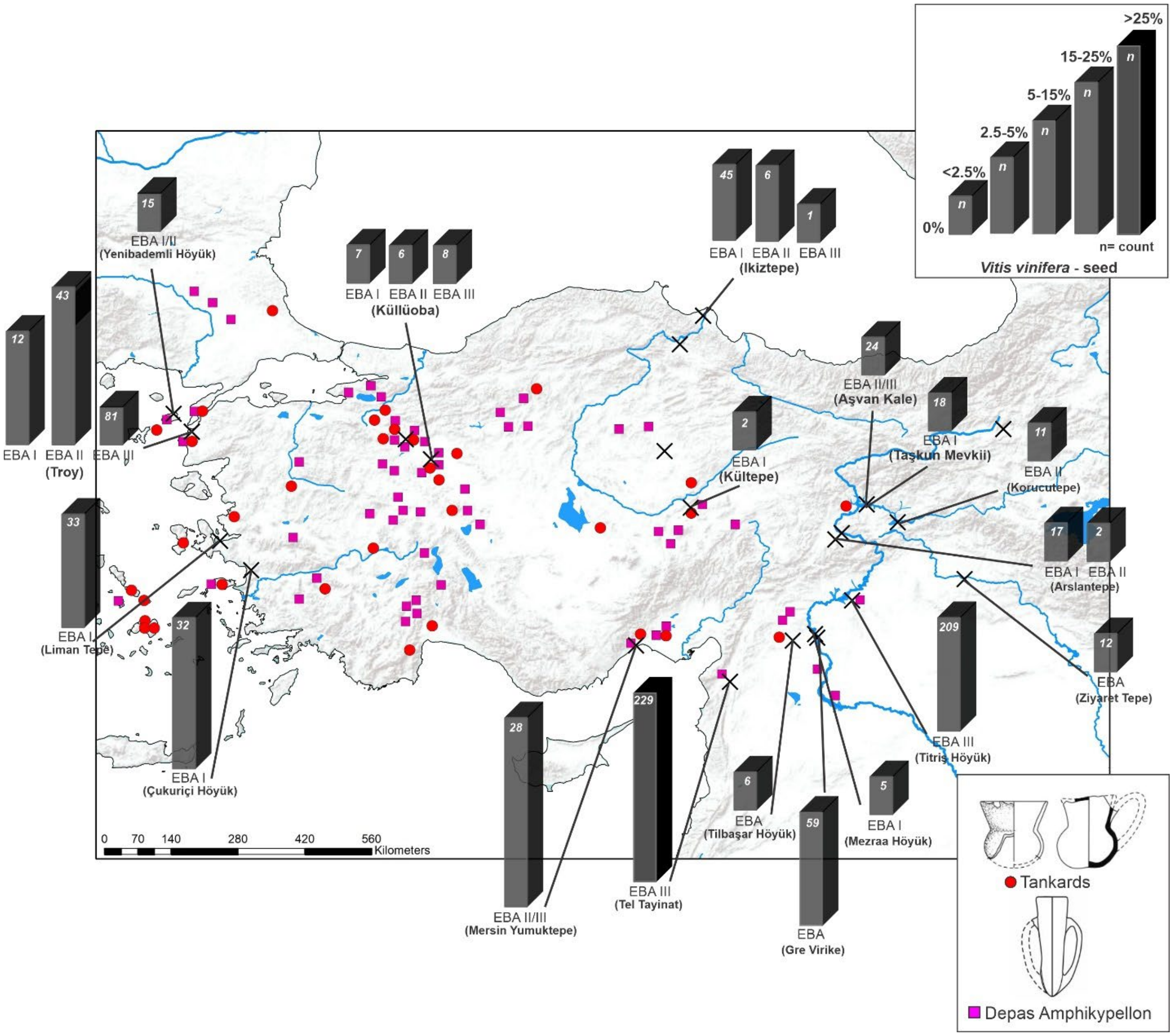

>25%
15-25%
5-15%
2.5-5%
<2.5%
0%
n
n= count
Vitis vinifera - seed
15
EBA I/II
(Yenibademli Höyük)
12
43
81
EBA I EBA II EBA III
(Troy)
7 6 8
EBA I EBA II EBA III
(Küllüoba)
45 6 1
EBA I EBA II EBA III
(Ikiztepe)
24
EBA II/III
(Aşvan Kale)
18
EBA I
(Taşkun Mevkii)
11
EBA II
(Korucutepe)
2
EBA I
(Kültepe)
17 2
EBA I EBA II
(Arslantepe)
12
EBA
(Ziyaret Tepe)
209
EBA III
(Titriş Höyük)
33
EBA I
(Liman Tepe)
32
EBA I
(Çukuriçi Höyük)
28
EBA II/III
(Mersin Yumuktepe)
229
EBA III
(Tel Tayinat)
6
EBA
(Tilbaşar Höyük)
59
EBA
(Gre Virike)
5
EBA I
(Mezraa Höyük)
0 70 140 280 420 560
Kilometers
● Tankards
■ Depas Amphikypellon

Figure 7.14 – *Occurrences of tankards and depas amphikypellon in Anatolia, based on* Çaliş-Sazci 2006*. Archaeobotanical sequences are located, with bar graph indicating classes of relative abundance of grape seeds. The numbers reported in the charts indicate the count of grape seeds (see* Table 7.1 *and* Figure 7.11*).*

The emergence of viticulture as a pivotal aspect of western Anatolian economies is further corroborated by the concurrent appearance and spread of ceramic types that are traditionally associated with wine drinking – such is the case of the 'Tankard-Type' and 'Depas Amphikypellon' vessels, which are typical of the Troy II (EBA II) ceramic horizon. Both types are attested in a wide geographic ambit, across both sides of the Aegean and as far east as the Euphrates (Çaliş-Sazci 2006) (Figure 7.14). Silver replica of these vessels found in hoards from Troy reinforce the association between wine consumption and the establishment of western Anatolian elites (Çaliş-Sazci 2006).

To conclude this section, a review of the available archaeobotanical dataset from Early Bronze Age Anatolia indicates the presence of well-defined agricultural regions (Figure 7.12). These differences could be tentatively associated with both specificities in local environments and of the socio-economic structures in which agricultural production was located. The latter are directly associated with the processes leading to the emergence of complex societies and early polities. In these regards, the archaeobotanical evidence is promising in contributing to these pivotal debates in the scholarship. Yet, the dataset remains too limited – despite the Early Bronze Age being the most intensively studied period in post-Neolithic Anatolia (Section 2.1.3).

7.4 *Middle Bronze Age (2000-1600 BCE): agriculture during the Assyrian Colony Period*

The Middle Bronze Age is associated in the literature to the establishment in the Anatolian Plateau of a constellation of city-state-like competitive polities, which directly engaged with Assyrian traders in a structured and institutionally-formalized long-distance trade network (Section 1.2.2). In which ways this new scenario impacted the production and management of agricultural staples?

7.4.1 - *The Middle Bronze Age archaeobotanical record: an overview*

The archaeobotanical evidence dating to the Middle Bronze Age (MBA) is summarized in Table 7.3. The cereal record is graphically presented in Figure 7.15, pulses and oilseeds in Figure 7.16, and fruits-nuts in Figure 7.17. The methodology used in these elaborations is outlined in Section 7.1.

The earliest period in Anatolian history informed by textual sources (Section 2.3.1) corresponds (sadly) to an important reduction in the number of published archaeobotanical records. The limited archaeobotanical coverage of the MBA is reflected both in the number of sites that produced quantitatively published archaeobotanical reports, as well as in sampling intensity at the single sites (Section 2.1.3). In short, for this period we have few, and generally poorly sampled, archaeobotanical sequences.

Published quantitative evidence from central Anatolia is available from Kültepe-*Kaneš* (32 samples; Fairbairn et al. 2013, Fairbairn 2014, Fairbairn and Wright 2017), Boğazkoy-*Hattuš* (number of samples not reported; Pasternak apud Schachner 2011), Kaman-Kalehöyük (5 samples; Nesbitt 1993), Gordion (2 samples; Miller 2010), Büklükale (4 samples; Fairbairn et al. 2019), and Boyalı Höyük (1 sample; Salih et al. 2009) (Section 2.1.3).

(Next page) Table 7.3 – *MBA archaeobotanical sequences, for references see Section 2.1.3 and Appendix 1. If the sum of the specimens in a given group (cereals, pulses, etc.) exceed the cutoff value of 100, data are provided as relative abundances calculated using the group total as sum. On the contrary, abundances are reported using a semi-quantitative scale (*= 1, += 2 to 9, ++= 10 to 24, +++= 25 to 49, ++++= >49).*

	Period	Samples	NISP	Cereals							Pulses						Fruits and Nuts			
				Barley (*Hordeum vulgare*)	Einkorn (*Triticum monococcum*)	Emmer (*Triticum dicoccum*)	Einkorn/Emmer (*T. monococcum/dicoccum*)	Free-Threshing Wheat (*Triticum aestivum/durum*)	Oat (*Avena* sp.)	Broomcorn Millet (Panicum miliaceaum)	Lentil (*Lens culinaris*)	Bitter Vetch (*Vicia ervilia*)	Fava Bean (*Vicia faba*)	Chickpea (*Cicer arietinum*)	Pea (*Pisum sativum*)	Field Peas (*Lathyrus* sp.)	Grape (*Vitis vinifera*)	Fig (*Ficus carica*)	Pomegranate (*Punica granatum*)	Hezelnut (*Corylus* sp.)
Central Anatolia																				
Boğazköy	MBA	nr	157	44%	6%	36%		13%			++	++	*		*	+	+			+
Boyalı Höyük	MBA	nr	18000																	
Büklükale	MBA	4	2641	+			+	++			+	+			+		40%	41%	8%	<1%
Gordion (YHSS 10)	MBA	2	29	++	+	*		++									*	*		
Kaman-Kalehöyük	MBA	5	878	11%	1%	1%	1%	86%			+	++		*	+		+			
Kültepe-Kanesh	MBA	32	1878	48%	4%	1%	11%	36%			69%	29%			3%		31%	38%	4%	22%
Eastern Anatolia																				
Sos Höyük (IVb)	MBA	20	1899	69%		3%		26%		2%	+	*			+					
Southeastern Anatolia																				
Hirbemerdon Tepe	MBA	18	56	+		+	+		*		+	*					+++			
Mezraa Höyük	MBA	2	55	+++							+				+		++			
Salat Tepe	MBA	5	466	82%	<1	7%		11%			+	++			+	++	+			
Ziyaret Tepe	MBA	23	5932	99%	<1%	1%		<1%		<1%	++	++	*	+	++	*	++	+		
Mediterranean																				
Tilmen Höyük	MBA	1	5	+																
Aegean																				
Troy (Troia V)	MBA	1	1837	100%																
Black Sea																				
Ikiztepe	MBA	18	1863	4%	2%	10%		84%			4%	40%				56%	+	+		

	Period	Walnut *(Juglans regia)*	Almonds *(Amygdalus* sp.)	European Plum *(Prunus domestica)*	Blackthorn *(Prunus spinosa)*	Pear/Apple *(Pyrus/Malus)*	Hawthorn *(Crataegus* sp.)	Cornellian Cherry *(Cornus mas)*	Sicilian sumac *(Rhus coriaria)*	Hackberry *(Celtis* sp.)	Brambles *(Rubus* sp.)	Elderberry *(Sambucus* sp.)	**Oilseeds and Varia**	Flax *(Linum usitatissimum)*	Gold-of-Pleasure *(Camelina sativa)*	Dill *(Anethum graveolens)*	Coriander *(Coriandrum sativum)*	Melons *(Cucumis melo/sativus)*	Carrot *(Daucus carota)*	Black Cumin *(Nigella sativa)*	Sesame *(Sesamum indicum)*
Central Anatolia																					
Boğazköy	MBA	*										*		+							
Boyalı Höyük	MBA																			100%	
Büklükale	MBA		1%	<1%	<1%	1%			2%	4%	4%					97%	2%	<1%			<1%
Gordion (YHSS 10)	MBA																				
Kaman-Kalehöyük	MBA						*														
Kültepe-Kanesh	MBA		1%			1%	1%	1%	1%					+							
Eastern Anatolia																					
Sos Höyük (IVb)	MBA														100%						
Southeastern Anatolia																					
Hirbemerdon Tepe	MBA																				
Mezraa Höyük	MBA																				
Salat Tepe	MBA																				
Ziyaret Tepe	MBA																		*		
Mediterranean																					
Tilmen Höyük	MBA																				
Aegean																					
Troy (Troia V)	MBA																				
Black Sea																					
Ikiztepe	MBA						*					+		+							

- *Cereal assemblages*

At both Boğazköy and Kültepe, archaeobotanical evidence suggests that cereal farming was based on hulled barley, emmer, and free-threshing wheat (Figure 7.15). On the basis of data from Boğazkoy, einkorn declined in importance in comparison to its former documented centrality during the Early Bronze Age (Külüoba and Demircihöyük) (Figure 7.9). This minor economic role of einkorn will remain attested also in later periods, with only singular exceptions (e.g., Early Iron Age Gordion and Kuşaklı; Section 7.6).

Free-threshing wheat is attested at both MBA Boğazköy and Kültepe, although it is more abundantly found at the latter site (Figure 7.15). Recently, Schachner (2022: 178) provided a preliminary diachronic overview of the crop assemblage from Boğazköy, based on both published and unpublished evidence. According to this more updated picture, not included in the elaborations here provided due to the lack of quantitative numeric data, a roughly equal contribution of barley, free-threshing wheat, and emmer defines the MBA cereal assemblage from the site.

The published record from Kaman-Kalehöyük is an outlier in the central Anatolia context, given an atypical abundance of free-threshing wheat and einkorn chaff (Figure 7.15). The singularity of this assemblage can be explained by limited sampling (Nesbitt 2013). More extensive archaeobotanical analyses from the same site are included in an unpublished dissertation (Üstünkaya 2015). According to a figure provided by Fairbairn and Wright (2017: 20), in the larger MBA dataset considered by Üstünkaya (2015), free-threshing wheat accounts for the 30% of the assemblage, which is a figure more in line with the roughly coeval sites of Boğazköy and Kültepe. Chaff remains from both Kaman-

Kalehöyük and Kültepe indicates that bread wheat (*Triticum aestivum* s.l.) was the dominant free-threshing wheat cultivar.

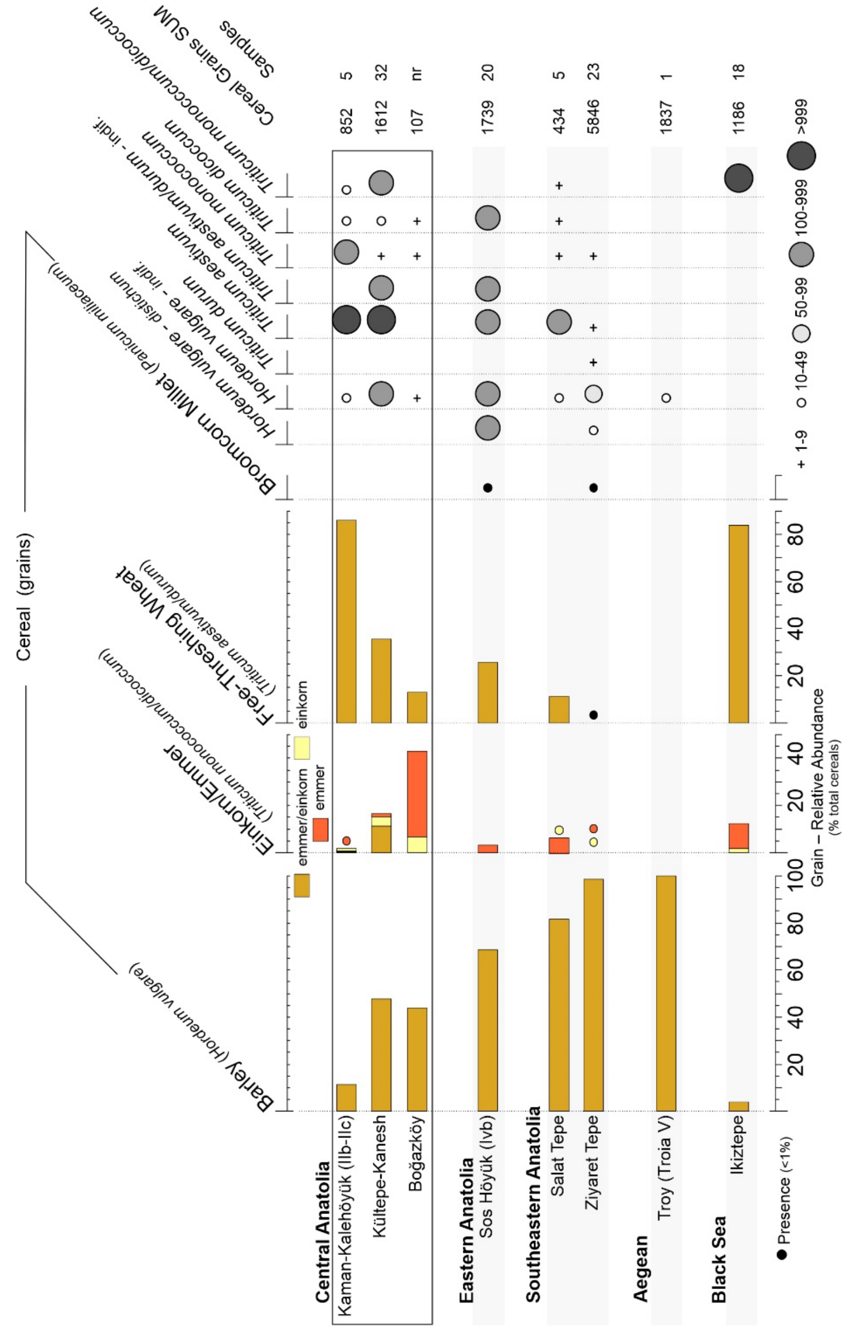


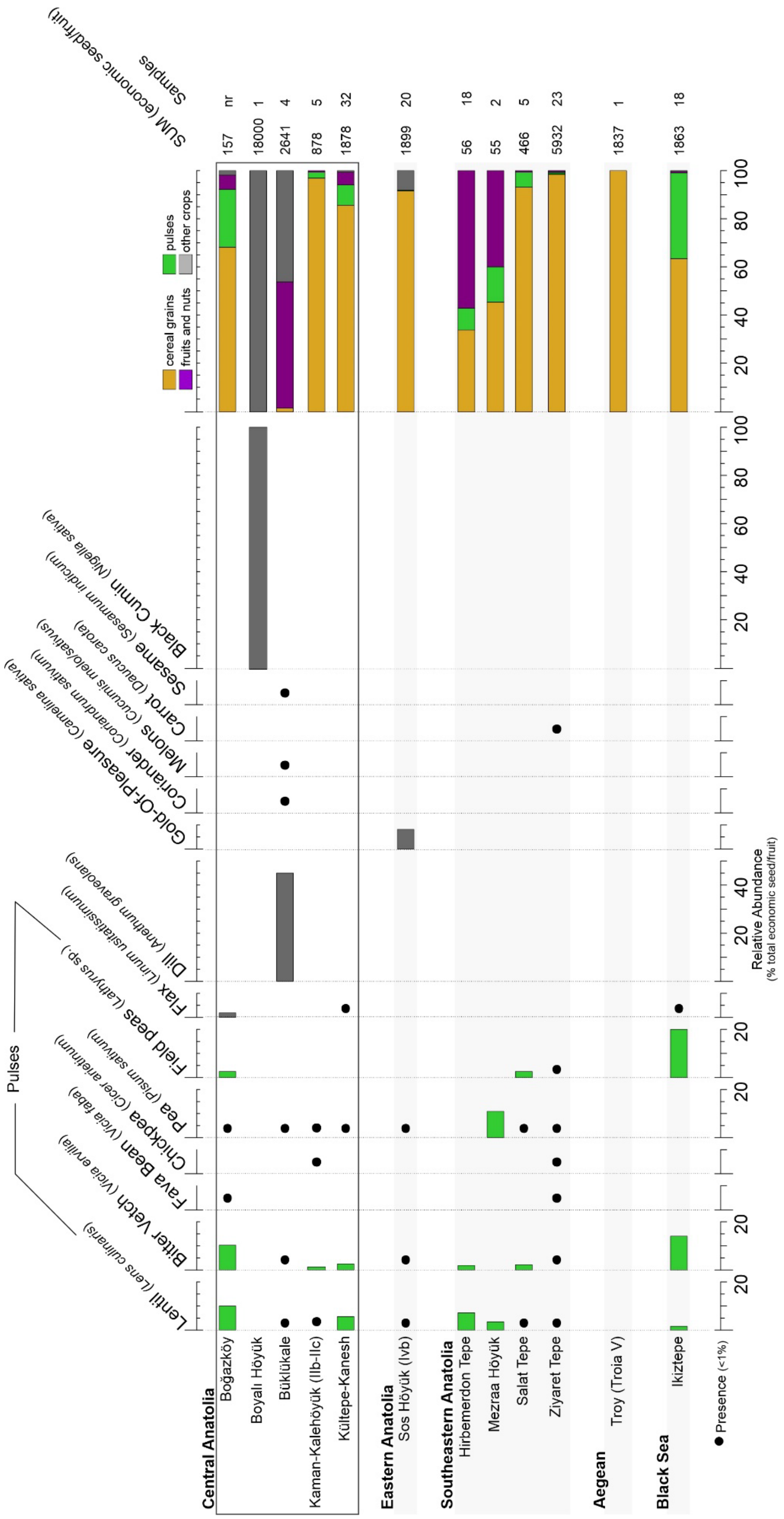
Figure 7.15 – *MBA archaeobotanical sequences: cereals. The graph is based on relative abundance calculated using the total of selected cereal grains as sum. Chaff is reported using a semi-quantitative scale. For further details see* Section 7.1*. Only assemblages with more than 50 cereal grains are included.*

The Middle Bronze Age is a period poorly investigated also outside central Anatolia (Table 7.3). In eastern Anatolia, the cereal assemblage from Sos Höyük (Level IVb) is in full continuity with the previous phase: free-threshing wheat and hulled two-row barley dominate the assemblage, with emmer playing a minor role, and einkorn remaining unattested (Figure 7.15). A degree of continuity with the EBA tradition is noted also at the southeastern Anatolia sites of Salat Tepe and Ziyaret Tepe. In line with the Early Bronze Age trend, both assemblages are characterized by the abundant attestation of barley and only a minor contribution of wheat (Figure 7.15).

Published archaeobotanical data for the Middle Bronze Age in the circum-Mediterranean region are to date virtually missing, with the sole exception of a single concentration of barley from Troy V (Table 7.3), and without considering here the samples from the later Troy VI settlement (MBA/LBA transition and LBA I), (Section 7.5). In the Black Sea, samples from the EBA/MBA transitional period at Ikiztepe indicates to an increased importance of the cultivation of free-threshing wheat, although its predominance at this site is in large part driven by a single pure cache (van Zeist 2003: 573).

- *Pulses, oilseeds, herbs, and spices*

Figure 7.16 summarizes the Middle Bronze Age pulses, oilseeds, herbs, and spices records. Among cultivated pulses, bitter vetch and lentil remain the most commonly encountered crops. Both taxa are found in comparatively low numbers, yet at almost all the sampled sites. In central Anatolia, chickpea and fava bean occur only sporadically, pointing to their minor economic role, which I have already observed and discussed in relation to the Early Bronze Age.


Central Anatolia
Boğazköy
Boyalı Höyük
Büklükale
Kaman-Kalehöyük (IIb-IIc)
Kültepe-Kanesh
Eastern Anatolia
Sos Höyük (Ivb)
Southeastern Anatolia
Hirbemerdon Tepe
Mezraa Höyük
Salat Tepe
Ziyaret Tepe
Aegean
Troy (Troia V)
Black Sea
Ikiztepe
● Presence (<1%)
Pulses
Lentil (Lens culinaris)
Bitter Vetch (Vicia ervilia)
Fava Bean (Vicia faba)
Chickpea (Cicer arietinum)
Pea (Pisum sativum)
Field peas (Lathyrus sp.)
Flax (Linum usitatissimum)
Dill (Anethum graveolens)
Gold-Of-Pleasure (Camelina sativa)
Coriander (Coriandrum sativum)
Melons (Cucumis melo/sativus)
Carrot (Daucus carota)
Sesame (Sesamum indicum)
Black Cumin (Nigella sativa)
SUM (economic seed/fruit)
Samples
157 nr
18000 1
2641 4
878 5
1878 32
1899 20
56 18
55 2
466 5
5932 23
1837 1
1863 18
cereal grains
fruits and nuts
pulses
other crops
20
40
60
80
100
Relative Abundance
(% total economic seed/fruit)

(Previous page) Figure 7.16 – *MBA archaeobotanical sequences: pulses, oilseeds, herbs, spices. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum (see* Section 7.1*). Only assemblages with more than 50 selected economic seed/fruit remains are included.*

Moving to oilseeds, of note is a pure concentration of *Nigella sativa* (black cumin) found in a ceramic flask ('Pilgrim-Type') from Boyalı Höyük, which is dated to the very late MBA (ca. 1650 BCE) (Salih et al 2009). This taxon is ethnographically known of having been exploited and cultivated for its pharmaceutical properties (e.g., Dabeer et al. 2022). It could be, thus, speculated that it was used for the same purposes also in Middle Bronze Age Anatolia. Leaving aside single occurrences, a second large concentration of black cumin has been found in the Hellenistic level of Aşvan Kale (Nesbitt et al. 2017: 51) (Section 7.7), which could suggest a long-standing Anatolian tradition in the use of this plant.

A second remarkably unique MBA archaeobotanical assemblage has been published from Büklükale. At this site, deposits sampled from an underground shaft-like room returned a rich charred and mineralized assemblage, which is dominated by fruits, nuts, spices, and other taxa usually rare in the archaeobotanical record (Fairbairn et al. 2019). Based on the overall archaeological evidence, Fairbairn et al. (2019) argued for a ritual interpretation of this depositional context. This assemblage includes seeds of dill (*Anethum graveolans*), coriander (*Coriandrum sativum*), melon (*Cucumis melo/sativus*), and sesame (*sesamum indicum*). These taxa are making here their first appearance in the Anatolian context, which in some instance will remain singular in the regional archaeobotanical dataset. More specifically: no other carpological finds of dill are reported in published sequences from Anatolia, sesame is attested only by single specimens from Iron Age sites (Kinet Höyük, Çizer 2006; Ziyaret Tepe, Rosenzweig 2014); coriander by isolated occurrences of single schizocarps at various sites and a large concentration found at the Iron Age (Urartian) fortress of Ayanis (Solmaz and Oybak Dönmez 2013); and cucurbits are otherwise attested exclusively at Roman (*Cucumis Melos* at Ephesus, Heiss and Thanheiser 2016; *Citrullus*-Type at Zeugma, Challinor and de Moulins 2013) or post-Roman (Marston and Castellano, *forthcoming*) sites.

- *Fruits and nuts*

In addition to the rich attestation of spices and herbs, the archaeobotanical assemblage from Büklükale is characterized by an equally atypical abundant and taxonomically diverse record of charred and mineralized fruits and nuts taxa: grape (*Vitis vinifera*), fig (*Ficus carica*), pomegranate (*Punica granatum*), hazelnut (*Corylus avellana*), Sicilian sumac (*Rhus coriaria*), and a variety of rosaceous taxa – including almond (*Amygdalus dulcis*), European plum (*Prunus domestica*), blackthorn (*Prunus spinosa*), pear/apple (*Pyrus/Malus*), and Brambles (*Rubus* sp.) (Figure 7.17). Among these taxa, hazelnut, sumac, and fig could be regarded on a phytogeographic basis as exotic to the central Anatolia vegetation (Fairbairn et al. 2019). To date we lack published samples from other depositional contexts from Büklükale. It remains, thus, challenging to properly contextualize this unique assemblage in the framework of the more general patten of plants use occurring at the site.

A comparatively rich assemblage of fruit and nuts originates also from Kültepe-*Kaneš*, which includes cornelian cherry (*Cornus Mas*), hazelnut, fig, and Sicilian Sumac (Figure 7.17). As already noted, in the central Anatolian context, the latter three taxa could be regarded as exotic. Grape seeds are found only sporadically at Kültepe, Kaman-Kalehöyük, and Boğazköy (Figure 7.17). Viticulture appears, thus, to have maintained a somehow marginal economic role, at least in the environs of the sampled sites.

The rich grape seeds record from Büklükale needs to be evaluated by its own, given the atypical nature of the deposit. It should be, finally, noted the attestation of walnut (*Juglans regia*) at Boğazköy (Figure 7.17), which represents the earliest published macroremain of this taxon in Anatolia. As previously noted, with the sole exception of a barley cache from Troy V, we lack published MBA archaeobotanical assemblages from the circum-Mediterranean region. It is, thus, to date, unfortunately, impossible to investigate how Early Bronze Age fruit crops farming (Section 7.3) developed into the Middle Bronze Age.

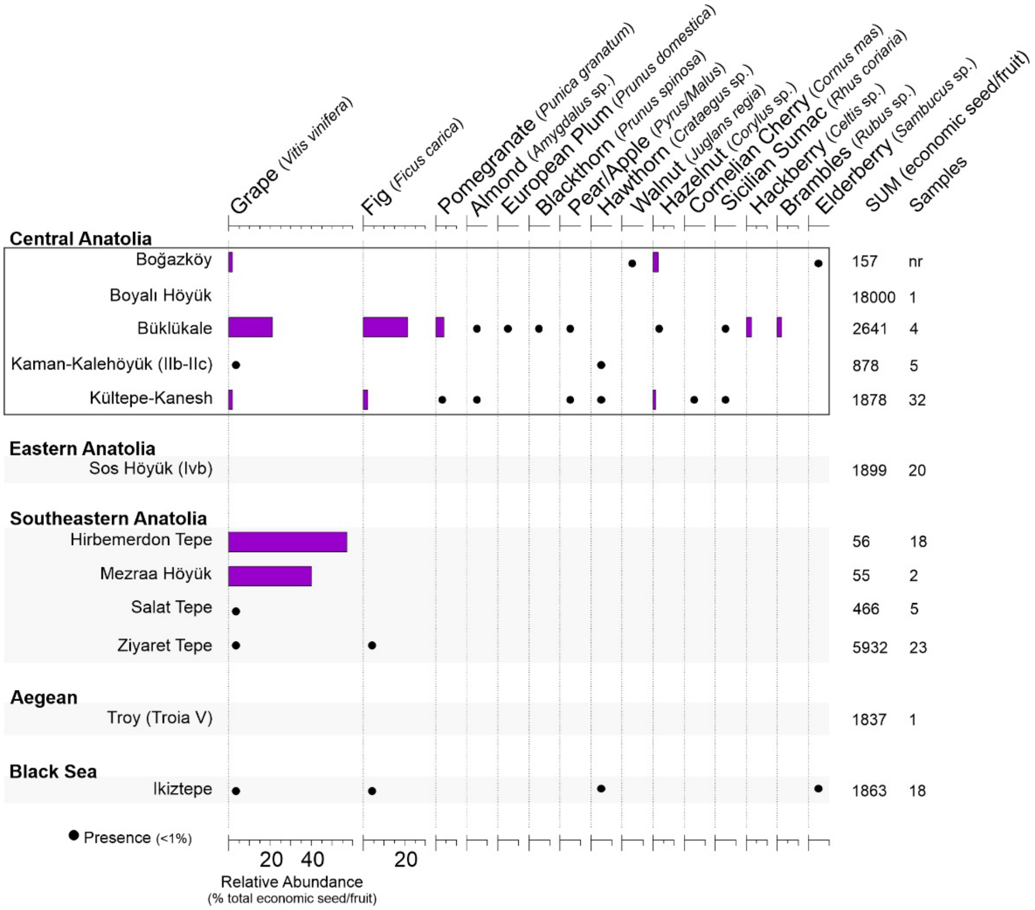


Figure 7.17 – *MBA archaeobotanical sequences: fruits and nuts. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum (see* Section 7.1.1*). Only assemblages with more than 50 selected economic seed/fruit remains are included in the figure.*

In continuum with the previous Early Bronze Age tradition (Section 7.3), viticulture maintained a central importance in southeastern Anatolia economies (Figure 7.17). The archaeobotanical record from this latter region needs, however, to be critically weighted against a particularly limited sampling and low specimen counts (Table 7.3). The importance of viticulture in the economy of this regions during the Middle Bronze Age is, nevertheless, further confirmed by the discovery at Hirbemerdon Tepe of a structure interpreted as a grape press (Laneri et al. 2016). For a more general discussion of viticulture and winemaking in MBA southeastern Anatolia, I refer to the overview provided by Laneri 2018.

7.4.2 - *Middle Bronze Age agriculture: subsistence, trade, and inequality*

The Middle Bronze Age corresponds in Anatolian history to the earliest textual records: Old-Assyrian documents which originated in the framework of trading activities conducted by Anatolian and Assyrian merchants; the latter settled in the lower town of the main Anatolian city-states (Section 1.2.2). The overwhelming majority of these documents were discovered at the site of Kültepe-*Kaneš*, which represented the Anatolian fulcrum in this long-distance trade network. In Section 2.3.1 I have reviewed the MBA textual record from Kültepe-*Kaneš* in connection with agricultural production. More specifically, I have provided an overview of (*i*) the crops attested in these sources, (*ii*) the farming techniques and implements, (*iii*) the landownership regimes, and (*iv*) the involvement of agricultural staples in the MBA economic system. There is no need to further rehash here these general considerations.

Against the poor archaeobotanical coverage of Middle Bronze Age Anatolia, Kültepe-*Kaneš* is to date the site that has been most intensively investigated (Fairbairn et al. 2013, Fairbairn 2014, Fairbairn and Wright 2017). A first starting point could be, thus, to directly compare the phytonyms reported in the tablets from *Kaneš* to the archaeobotanical record from the same site.

As discussed in Section 2.3.1 there is reasonable consensus in identifying in the cuneiform record from *Kaneš* five terms referring to cereals: three Akkadian word (*še'um*, *aršātum*, *uṭṭutum*) and two Sumerograms (GIG, ŠE). ŠE is equated to *še'um* and translated as "barley", GIG to *aršātum* and translated as "wheat", while *uṭṭutum* is regarded as a generic term indicating "cereal grain" (Hoffner 1974: 59, Michel 1997: 99, Dercksen 2008a: 144). The Akkadian term referring elsewhere (in Mesopotamia) to emmer (*kunāšum*) is to date unattested in the Old Assyrian corpus from *Kaneš*.

If we turn our attention to the archaeobotanical record (Table 7.2), the cereal assemblage from MBA Kültepe-*Kaneš* was based on hulled barley, free-threshing wheat (according to rachis fragments *Triticum aestivum* s.l.), and hulled wheats (einkorn and emmer). Although free-threshing wheat is found more abundantly, hulled cultivars are attested in meaningful quantities, supporting their status as crops (Figure 7.15). Given the unique extension of the textual record from *Kaneš* (more than 22,500 tablets, Barjamovic 2011:55), the lack of a specific term indicating these latter cereals calls for an explanation. Contrary to Dercksen opinion (2008a: 144), in fact, archaeobotanical evidence suggests that hulled wheats were still a comparatively important component of Anatolian farming. How to explain this discrepancy between the textual and archaeobotanical records?

A first possibility could be to consider a translation of GIG=*aršātum* as a generic term for "wheat", without distinguishing between hulled or naked cultivars. This hypothesis is, in my opinion, unlikely. These differences between free-threshing and hulled wheats are too macroscopic to be overlooked in economic-oriented archives such as the ones from *Kaneš*. These differences have, in fact, important repercussions on their cultivation, processing, storing, and suitable uses (e.g., Nesbitt and Samuels 1996b). For instance, if free-threshing wheat is known to have been farmed and processed together with barley (Halstead and Jones 1989: 52, Jones and Halstead 1995: 109, Marston 2011: 192), its cultivation mixed with hulled wheat is ethnographically only singularly attested (Zaharieva et al. 2010, with references). As an alternatively hypothesis, we could speculate that only a specific cultivar, perhaps free-threshing wheat given its predominance in the record, was involved in the transactions documented in the cuneiform corpus from *Kaneš*. This issue to date remains open.

The archaeobotanical evidence from Kültepe-*Kaneš* could be further discussed in terms of possible differences in the records from the citadel (seat of the local ruling elites) and the lower town (where the Assyrian colony was located) (Section 1.2.2). Such discussion has been already provided by Fairbairn and Wright (2017). On the basis of the available data, differences between the citadel and the lower town is quantitative rather than qualitative: hulled wheat is more common in the citadel, while free-threshing wheat occurs more frequently in the lower town (Fairbairn and Wright 2017). The authors, furthermore, note a higher grain-to-chaff ratio in the lower town, which would suggest a greater use of prime (clean) grains in the area of the site settled by the Assyrian merchants (Fairbairn and Wright 2017). This evidence suggests that early stages in cereal processing were conducted outside the lower town. Only modest amounts of cereals were stored in the residential contexts of the lower town, using ceramic containers (Özgüç 2003: 88–90). Similar storage structures are known from the roughly coeval lower town (*karum*) of Boğazköy (Schachner 1999: 116). The presence of private large-scale storage elsewhere at the site or in its proximity is, nevertheless, to be assumed, as suggested by the large amounts of grain that are documented in various transactions – with values up to 19200 liters in a single grain loan (Kt89/k358, Donbaz 1996: 193; see also Section 2.3.1). Such large quantities of cereals circulating in the private economy of *Kaneš* hint to the existence of structures where these agricultural surpluses were stored.

On the basis of both archaeological and textual evidence, the central political institution (palace) of *Kaneš* does not appear to have been involved in a centralized control of staples production, accumulation, and distribution (Dercksen 2008a, 2008b). The lack of an apparent direct involvement of the political power in agricultural production could represent an aspect of continuity with the Early Bronze Age political economies (see Section 7.3). The growing palatial administrative apparatus, with more than forty different functionaries attested in documents from *Kaneš* (e.g., Michel 2017), implies that the subsistence of several people was likely dependent either directly or indirectly on the central authority. The presence of storing areas within the Anatolian MBA palaces could be interpreted along these lines. Storerooms have been exposed at the MBA palace of Acemhoyuk (Özgüç 1966: 37) and possibly Kültepe itself (Kalakoglu 2011: 1015). In both instances, storage is conducted in pithoi, without anything comparable in scale and technology to the chronological later Late Bronze Age (Hittite) tradition of massive, centralized storage of agricultural staples (Section 7.5).[35]

In short, available evidence suggests that the Middle Bronze Age Anatolian the palaces did not command an extensive food storage and redistributive system, but rather they accumulated agricultural surplus only to meet their own necessities in terms of both foodstuff and grain-seeds (Bachhuber 2012: 579-580). The political and economic power of the local Anatolian rulers, thus, was likely disconnected from production and distribution of agricultural products. Nevertheless, outside the immediate palatial context, it is clear that staple products played an important source of social and economic power of individual actors within the MBA society. I will briefly elaborate on this topic in the following paragraphs.

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[35] A large pit found in the citadel of Kültepe (Levels 10-9, ca. 2050-1950 BCE) was preliminarily interpreted by excavators as a silo (Kulakoğlu et al. 2013: 46), but later reinterpreted as a garbage pit and omitted from the final publication of the EBA III/MBA I architecture (Ezer 2014: 20). This evidence remains to date unclear.

As noted in Section 2.3.1, in addition to having a transactional currency-like value, at *Kaneš* quantities of cereal grains often occurs in debt notes – in form of loans, of interests on the debts, and security pledges (e.g., Dercksen 2008b, Veenhof 2017). Thus, a profit gain, in the proper sense of the term (e.g., Risch 2016), was obtained from agricultural surpluses. In the available documents, the origin of the specific debts is not stated, yet it could be reasonably argued that they could have represented advances for grains to be delivered at the harvest season – i.e., in rural contexts a farming-credit intended for obtaining the necessary grain-seeds to be used in the sowing season (Veenhof 2017). The interests reported in these debt notes are generally comprised between the 30% and the 60% of the loan, both lands and personal freedom often occur as pledges (Veenhof 2017). The unpredictability in agricultural yields, typical of central Anatolian rain-fed farming (e.g., Schachner 2022), could have exacerbated these processes of indebtment, which might have contributed to a higher degree of social and economic stratification. The fact that indebtment, loss of property, and debt bondages were matter of concern for the social equilibrium could be inferred by the attestation of debt relief edicts (the "*washing of the debts*") issues by the royal palace (Veenhof 2017: 679, with references). Emblematic in these regards is the attestation in debt notes of a specific clause concerning the inapplicability of such royal measures (Veenhof 2017: 679), which ultimately hints to the degree of existing friction between the palatial and extra-palatial economic domains.

Before closing this section on the Middle Bronze Age, I shall make some brief considerations in regard to some technical aspects of agriculture production at *Kaneš*. As noted (Section 2.3.1), textual evidence (e.g., Dercksen 2008a) supports the presence of irrigation in the agricultural landscape of Kültepe-*Kaneš*. The predooming in barley of poly-rowed varieties (Fairbairn 2014: 184) might speculatively sustain the presence of artificial watering of cereal plots. Although the actual extension of irrigated arable land remains unclear, the application of supplementary irrigation to rain-fed fields, in addition to stabilizing the inter-annual production, could have potentially significantly increased the yields (e.g., ICARDA 2012). I will further discuss this aspect in relation to Late Bronze Age agriculture (Section 7.5). A possible introduction of the seeder-plough, which is documented (Akkadian *epinnum*) in the textual documents from *Kaneš* (Section 2.3.1), could have, furthermore, significantly reduced grain-seed losses in comparison to broadcasting. Thus, ultimately contributing to an increase in yield-to-seed ratios (see discussion provided in Section 2.3.1, with references).

The actual presence and extension in use of these two technologies remain to date unclear. Yet, it is tempting to recognize in the central Anatolian Middle Bronze Age a phase of technical innovations in agricultural practice. Either directly (technological transfer) and indirectly (stimulus to overproduction), the prolonged and close interactions between Anatolians and Assyrians could have promoted these processes.

7.5 *Late Bronze Age (1600-1180 BCE): agriculture during the Hittite kingdom*

The Late Bronze Age corresponds to the establishment, apogee, and collapse of the Hittite kingdom. The latter represents the first territorial power emerging in the Anatolian Plateau. An introduction to Late Bronze Age history and archaeology has been provided in Section 1.2.3. Which role agriculture played in the political economy of the Hittite Empire?

7.5.1 - *The Late Bronze Age archaeobotanical record: an overview*

The archaeobotanical evidence dating to the Late Bronze Age (LBA) is summarized in Table 7.4. The cereal record is presented in Figure 7.18, pulses and oilseeds in Figure 7.19, and fruits-nuts in Figure 7.20. The methodology used in these elaborations is outlined in Section 7.1.

Published quantitative evidence from central Anatolia is available from the sites of Boğazkoy-*Hattuša* (more than 48 samples; Pasternak 2003 and 2012, Diffey et al. 2020), Gordion (32 samples; Miller 2010), Kuşaklı-*Šariššа* (more than 17 samples; Müller-Karpe et al.1995, 1998, and 2000), Ortaköy-*Šapinuva* (2 samples; Oybak Dönmez 2019), and Niğde-Kınık Höyük (2 samples) (Section 2.1.3). The latter site has been investigated in the framework of this dissertation (Chapter 5 and 6). Because of a thick post-Bronze Age stratigraphic deposit, the possibility to collect an adequate number of 2nd millennium BCE samples at Kınık Höyük was limited (Section 3.4.3). Quantitative data from Kaman-Kalehöyük are to date unpublished (Üstünkaya 2015). Outside central Anatolia, particularly well-studied are the sequences from Tell Atchana (328 samples; Çizer 2006, Riehl 2010, Stirn 2013), in the Mediterranean region; Kaymakçı (320 samples; Shin et al. 2021), in the Aegean hinterland; and Oymaağaç-*Nerik*, in Northern Anatolia (108 samples; Czichon et al 2017, Ulaş 2019) (see Section 3.4.3)

	Period	Samples	NISP	Cereals												Pulses			
				Barley *(Hordeum vulgare)*	Naked Barley *(Hordeum vulgare var. nudum)*	Einkorn *(Triticum monococcum)*	Emmer *(Triticum dicoccum)*	Einkorn/Emmer *(T. monococcum/dicoccum)*	Spelt *(Triticum spelta)*	New Glume Wheat (*Triticum* NGW)	Free-Threshing Wheat *(Triticum aestivum/durum)*	Rye *(Secale cereale)*	Oat (*Avena* sp.)	Broomcorn Millet (Panicum miliaceaum)	Foxtail Millet *(Setaria italica)*	Lentil *(Lens culinaris)*	Bitter Vetch *(Vicia ervilia)*	Fava Bean *(Vicia faba)*	Chickpea *(Cicer arietinum)*
Central Anatolia																			
Boğazköy (Silocomplex)	LBA	45	116309	69%	<1%	4%	26%				<1%					1%	5%	94%	
Boğazköy	LBA	>3	661	50%		2%	35%				13%					59%	14%	10%	
Gordion (YHSS 8/9)	LBA	32	1457	59%		1%	<1%				40%	<1%				6%	94%		
Kınık Höyük (KH-P VI)	LBA	2	38	++							++					+	+		
Kuşaklı (Level 2, 3)	LBA	>17	92534	65%		<1%	12%		<1%		22%				<1%	+++	++		
Ortaköy	LBA	2	401005	<1%							100%								
Eastern Anatolia																			
Aşvan-Aşvan Kale	LBA	2	265	64%							36%						++++		
Southeastern Anatolia																			
Karkemish	LBA	6	44.5	+++															
Tille Höyük	LBA	2	7810	<1%							100%						100%		
Ziyaret Tepe	LBA	8	93	++++			+				+			*		++			
Mediterranean Transitional																			
Beycesultan	LBA	7	108	+	+	+	++++				+					+++	+		
Mediterranean																			
Kilise Tepe	LBA	33	13455.5	76%		22%	1%	<1%	1%		<1%			<1%		68%	<1%	<1%	
Kinet Höyük	LBA	31	331	38%			4%				58%					++++	+	++	+
Tatarlı Höyük	LBA	4	3				+												
Tell Atchana	LBA	328	4131	24%			2%			<1%	73%		<1%			15%	84%	<1%	<1%
Aegean																			
Kaymakçı	LBA	328	678	74%		6%	2%				17%					2%	86%	1%	11%
Troy (Troia VI)	LBA	14	6880	94%		2%	3%	1%			<1%			1%		1%	93%	1%	5%
Troy (Troia VIIa)	LBA	19	43677	26%		20%	31%	21%			1%			1%			62%		38%
Black Sea																			
Oymaağaç	LBA	106	312	58%	12%	5%	3%	<1%			20%	<1%				++	++	*	

					Fruits and Nuts												**Oilseeds and Varia**	
	Period	Pea (*Pisum sativum*)	Field Peas (*Lathyrus* sp.)		Grape (*Vitis vinifera*)	Fig (*Ficus carica*)	Olive (*Olea europaea*)	Pomegranate (*Punica granatum*)	Hezelnut (*Corylus* sp.)	Plums-genus (*Prunus* sp.)	Pear/Apple (*Pyrus/Malus*)	Hawthorn (*Crataegus* sp.)	Pistachio (*Pistacia* sp.)	Oak (*Quercus* sp.)	Brambles (*Rubus* sp.)	Elderberry (*Sambucus* sp.)	Flax (*Linum usitatissimum*)	Gold-of-Pleasure (*Camelina sativa*)
Central Anatolia																		
Boğazköy (Silocomplex)	LBA		14%		*					*	*		*		+			
Boğazköy	LBA	6%	10%		+				+++	*			+		*	+	+	
Gordion (YHSS 8/9)	LBA				*													
Kınık Höyük (KH-P VI)	LBA																	
Kuşaklı (Level 2, 3)	LBA	*	+		++							+	+				*	
Ortaköy	LBA						+							*				
Eastern Anatolia																		
Aşvan-Aşvan Kale	LBA				*													
Southeastern Anatolia																		
Karkemish	LBA				+													
Tille Höyük	LBA		<1%															
Ziyaret Tepe	LBA		*		+	+												
Mediterranean Transitional																		
Beycesultan	LBA				*													
Mediterranean																		
Kilise Tepe	LBA	5%	27%		9%	90%	1%										*	
Kinet Höyük	LBA				++	++		++										
Tatarlı Höyük	LBA																	
Tell Atchana	LBA		1%		31%		69%										+	
Aegean																		
Kaymakçı	LBA		<1%		++++	+												
Troy (Troia VI)	LBA				32%	67%									1%		+	+
Troy (Troia VIIa)	LBA		<1%		39%	60%	1%							1%				+++
Black Sea																		
Oymaağaç	LBA	*	+		+	++	+			*			*		*		*	

(Previous page) Table 7.4 – *LBA archaeobotanical sequences, for references see* Section 2.1.3 *and* Appendix 1. *If the sum of the specimens in a given group* (*cereals, pulses, etc.*) *exceed the cutoff value of 100, data are provided as relative abundances calculated using the group total as sum. On the contrary, abundances are reported using a semi-quantitative scale* (**= 1, += 2 to 9, ++= 10 to 24, +++= 25 to 49, ++++= >49*).

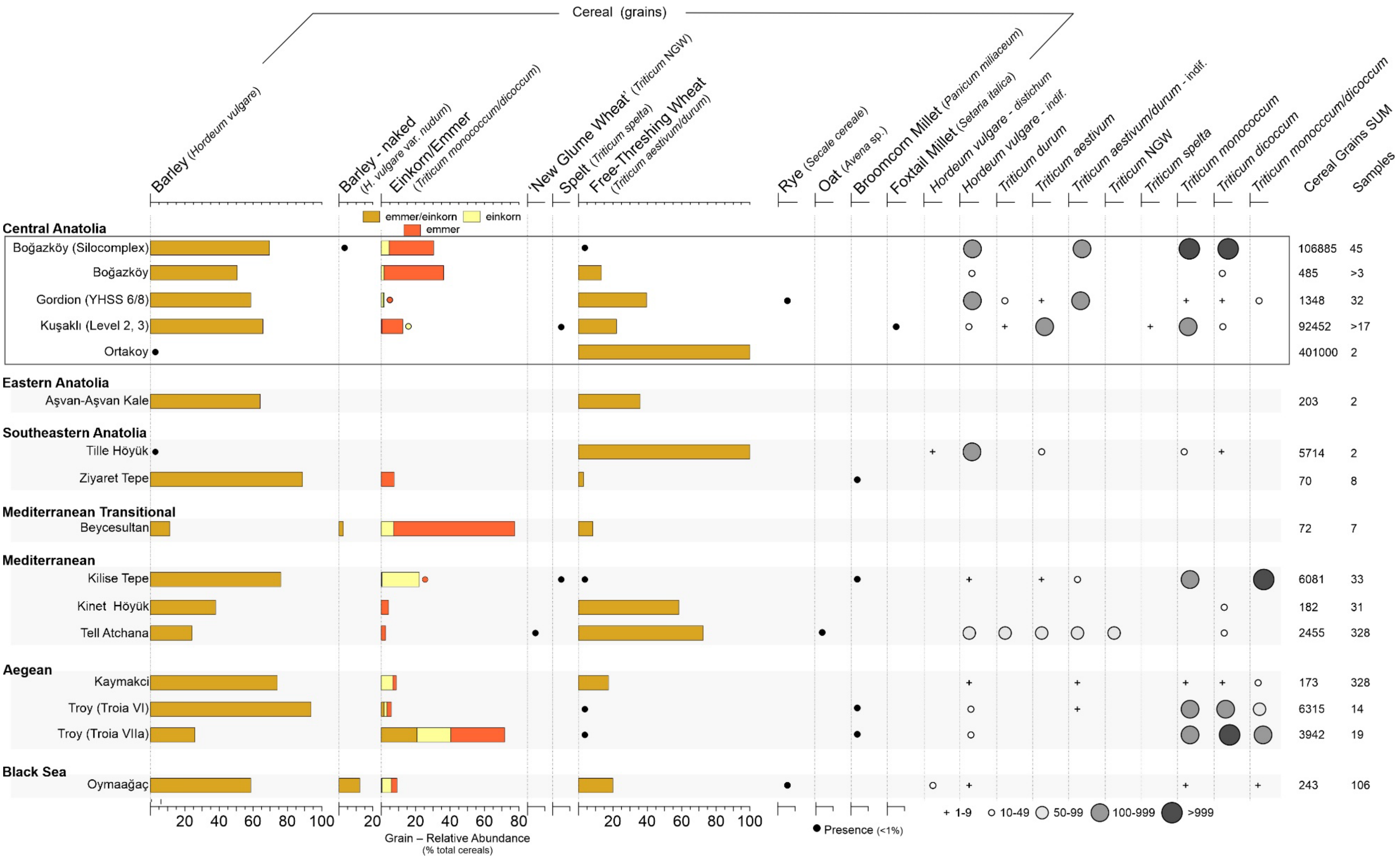
- *Cereal assemblages*

A review of the archaeobotany of Late Bronze Age central Anatolia should start from one of the most impressive archaeobotanical contexts so far published from the region: the Silo-Complex, a granary brough to light in the lower city of the Hittite capital Boğazköy-*Hattuša*. The scale of this structure is remarkable: 32 rectangular chambers, encompassing a total length of 118 m and a breadth of 33-40 m (Seeher 2006: 49). Based on these measures, it could be estimated a total storage volume of between 7000 and 9000 m^2 (Seeher 2006: 81), which at maximum capacity corresponds to a hypothetic figure of between 5500 and 7000 metric tons of cereal grains (Diffey et al. 2020). Twelve chambers were destroyed by a conflagration, which allowed the preservation of cereal grains in layers (ca. 1.20 m thick), which were sealed by the original earth plug (Diffey et al. 2020). Carpological analyses were conducted on subsamples from five chambers (12, 28, 29, 30 and 32) (Diffey et al. 2020). On the basis of nine radiocarbon determinations, the destruction of the Silo-Complex is dated to the first half of the 16th century BCE (Seeher 2006: 74–78, Schoop and Seeher 2006: 59–60).

The sampled chambers of the Silo-Complex contain a mixture of cereal grains, cereal chaff, pulses, and weeds. In all the analyzed contexts, hulled barley was predominant, followed by emmer (Table 7.4, Figure 7.18). Einkorn is attested in more modest quantities, reaching maximum attestation (7% of total cereals) in chamber 30 (Diffey et al. 2020). Naked barley and free-threshing wheat are only occasionally attested (Table 7.4, Figure 7.18). Hulled wheats were stored as whole spikelet, as to some degree expected (e.g., Nesbitt and Samuels 1996b). The weed assemblage includes taxa that mimic cereals in size and weight (e.g., *Bifora radians*, *Vaccaria pyramidata*, *Lolium persicum*, *Avena* sp., *Neslia paniculata*, *Galium triconutum*, *Ranunculus arvensis*, *Polygunum aviculare*), which would suggest that the product stored in the granary's chambers was already at an advance (post-sifting) processing stage (Diffey et al. 2020). With the sole exception of small-seeded fava bean (*Vicia faba* var. *minuta*), pulses occur in minor quantities, likely representing either contaminants of the stored crops or weeds (Diffey et al. 2020). I will discuss the evidence of fava bean later in this section, as part of a discussion of pulses in Late Bronze Age central Anatolia.

In addition to the Silo-Complex, archaeobotanical research at Late Bronze Age Boğazköy has been conducted on other depositional contexts (Pasternak 2003, 2012). As I have noted in Section 7.4, the results of archaeobotanical research conducted at Boğazköy on materials sampled during recent excavation campaigns (2013-2018) still await full publication. Nevertheless, the preliminary evidence presented by Schachner (2022: 178) appears to confirm the trends documented in earlier (published) research. In short, the cereal assemblage from the Hittite capital is dominated by hulled barley. Emmer appears to have been the second most-important cereal crop, followed by free-threshing wheat – this latter taxon, which is only singularly attested in the Silo-Complex, is more commonly encountered in other LBA contexts from the site (Table 7.4 and 7.18).

(Next page) Figure 7.18 – *LBA archaeobotanical sequences: cereals. The graph is based on relative abundance calculated using the total of selected cereal grains as sum. Chaff is reported using a semi-quantitative scale. For further details see Section 7.1. Only assemblages with more than 50 cereal grains are included.*



Cereal (grains)
Barley (Hordeum vulgare)
Barley - naked (H. vulgare var. nudum)
Einkorn/Emmer (Triticum monococcum/dicoccum)
'New Glume Wheat' (Triticum NGW)
Spelt (Triticum spelta)
Free-Threshing Wheat (Triticum aestivum/durum)
Rye (Secale cereale)
Oat (Avena sp.)
Broomcorn Millet (Panicum miliaceum)
Foxtail Millet (Setaria italica)
Hordeum vulgare - distichum
Hordeum vulgare - indif.
Triticum durum
Triticum aestivum
Triticum aestivum/durum - indif.
Triticum NGW
Triticum spelta
Triticum monococcum
Triticum dicoccum
Triticum monocccum/dicoccum
Cereal Grains SUM
Samples
emmer/einkorn
einkorn
emmer
Central Anatolia
Boğazköy (Silocomplex) 106885 45
Boğazköy 485 >3
Gordion (YHSS 6/8) 1348 32
Kuşaklı (Level 2, 3) 92452 >17
Ortakoy 401000 2
Eastern Anatolia
Aşvan-Aşvan Kale 203 2
Southeastern Anatolia
Tille Höyük 5714 2
Ziyaret Tepe 70 8
Mediterranean Transitional
Beycesultan 72 7
Mediterranean
Kilise Tepe 6081 33
Kinet Höyük 182 31
Tell Atchana 2455 328
Aegean
Kaymakci 173 328
Troy (Troia VI) 6315 14
Troy (Troia VIIa) 3942 19
Black Sea
Oymaağaç 243 106
20 40 60 80 100
20
20 40 60 80
20 40 60 80 100
Grain – Relative Abundance
(% total cereals)
● Presence (<1%)
+ 1-9
○ 10-49
50-99
100-999
>999

The cereal record from the Hittite town of Kuşaklı-*Šariššа*, in the Sivas districts, is in many regards resembling the evidence for Boğazköy: barley is the dominant crop, followed by free-threshing wheat (*T. aestivum* s.l., based on chaff) and emmer (Figure 7.18). In addition to sporadic einkorn grains and chaff, to be mentioned is the singular occurrence of spelt (grains and chaff) and foxtail millet (Figure 7.18). Given their presence as single specimens, the cultivated status of these crops in the landscape of Late Bronze Age Kuşaklı cannot be confirmed.

At Gordion, the Late Bronze Age is the earliest period covered by a significant number of samples (Section 2.1.3) (Miller 2010, Martson 2017). The cereal assemblage from this latter site is distinct in comparison with both Boğazköy and Kuşaklı: hulled wheat is only singularly attested, with the cereal record quantitatively dominated by barley and, in lower amounts, free-threshing wheat (Figure 7.18, Table 7.4). Free-threshing wheat is predominant at Ortaköy, the Hittite royal residence of *Šapinuva* (Section 1.2.3). This record originates, however, from a single storage context – thus, very poorly indicative of the more general patterns of plant use at the site.

On the westernmost fringes of central Anatolia, in the transitional region between the Plateau and the Mediterranean region, early archaeobotanical research has been conducted at the site of Beycesultan (Helbaek 1961). As I have already pointed out in Section 2.1.3, recent field work conducted at this site has called into question the absolute chronology of Bronze Age levels at Beycesultan (Dedeoğlu and Abay 2014). More specifically, new stratigraphic and radiometric evidence support a Middle Bronze Age dating for Level II, which was previously attributed to the Late Bronze Age. On the basis of the original absolute dating (Lloyd 1972), the emmer-dominated assemblage from Beycesultan is here included along with other Late Bronze Age sites (Figure 7.18, Table 7.4). Yet, pending further research, the chronology of these samples requires to be cautiously evaluated.

Moving to other regions, eastern Anatolia remains to date poorly covered by archaeobotanical research for the Late Bronze Age (Section 2.1.3). Two samples have been published from the LBA occupation of Aşvan Kale, which are dominated by barley followed by free-threshing wheat (Figure 7.18). In southeastern Anatolia, a single large cache of free-threshing wheat is reported from Tille Höyük (Figure 7.18). Comparatively more intensively sampled is the site of Ziyaret Tepe, in the Tigris Valley. The cereal assemblage at this latter site is dominated by hulled barley, with only a minor contribution of emmer and free-threshing wheat (Figure 7.18). The cereal record from Ziyaret Tepe is, thus, in continuity with the regional trend attested in the previous periods (Section 7.3 and 7.4).

In the Mediterranean region, the two intensively studied sites of Kinet Höyük (Gulf of Iskenderun) and Tell Atchana (Amuq Valley) are characterized by having a similar cereal record, defined by a preponderance of free-threshing wheat over barley, and a minor contribution of emmer (Figure 7.18). A radically different picture emerges at Kilise Tepe, in rough Cilicia. Samples from the LBA/EIA transitional period (ca. 1275-1150 BCE; Postgate and Thomas 2007) (see Section -2.1.3) are here characterized by an atypical abundance of einkorn, attested both as grain and chaff. Free-threshing wheat, on the contrary, occurs only sporadically (Figure 7.18, Table 7.4). The importance of einkorn at late LBA Kilise Tepe is confirmed by more recent research (Bouthillier et al. 2014: 131), which still awaits full publication. The site of Kilise Tepe will remain an outlier also during the Iron Age (Section 7.6), which tentatively suggests the presence of a long-lasting local emphasis in einkorn farming.

In the Aegean region, Late Bronze Age archaeobotanical evidence is published from Kaymakçı and Troy (Section 2.1.3). The record from Kaymakçı is characterized by an abundant occurrence of barley, with a more limited attestation of free-threshing and hulled wheats (Figure 7.18, Table 7.4). Barley is the predominant cereals also at Troy VI (ca. 1750-1300 BCE). The marked dominance of barley at the latter site is, however, partially driven by a single large cache of this crop (Riehl 1999). Hulled wheats, both einkorn and emmer, dominate the cereal record during the following Troy VIIa (1300-1180 BCE) (Figure 7.18, Table 7.4). Both at Kaymakçı and Troy, free-threshing wheat is almost absent (Figure 7.18, Table 7.3). I should finally note the comparatively abundant attestation of broomcorn millet at LBA Troy (32 grains in Period VII, 57 in period VIIa), which could support its early cultivation in the environs of the site.

In the Black Sea region, the only Late Bronze Age archaeobotanical sequence to date published originate from the site of Oymaağaç, which is identified with the sacred city of *Nerik* (Section 1.2.3). LBA samples from this site are dominated by hulled barley, with a quantitatively secondary contribution of hulled (einkorn and emmer) and free-threshing wheat. Of note is the comparatively frequent attestation of naked barley, a crop which is otherwise attested in Anatolian post-Chalcolithic contexts by single specimens (see Section 7.2.1).

- *Pulses and oilseeds*

Pulses and oilseeds from Late Bronze Age archaeobotanical assemblages are reported in Figure 7.19 and in Table 7.4. As already briefly mentioned, atypical in the central Anatolian context is the comparatively abundant attestation of fava bean in the Silo-Complex (chambers 12 and 32) of

Boğazköy-*Hattuša* (Diffey et al. 2020). To a minor degree, fava bean is found also in other contexts sampled from Boğazköy (Figure 7.19).

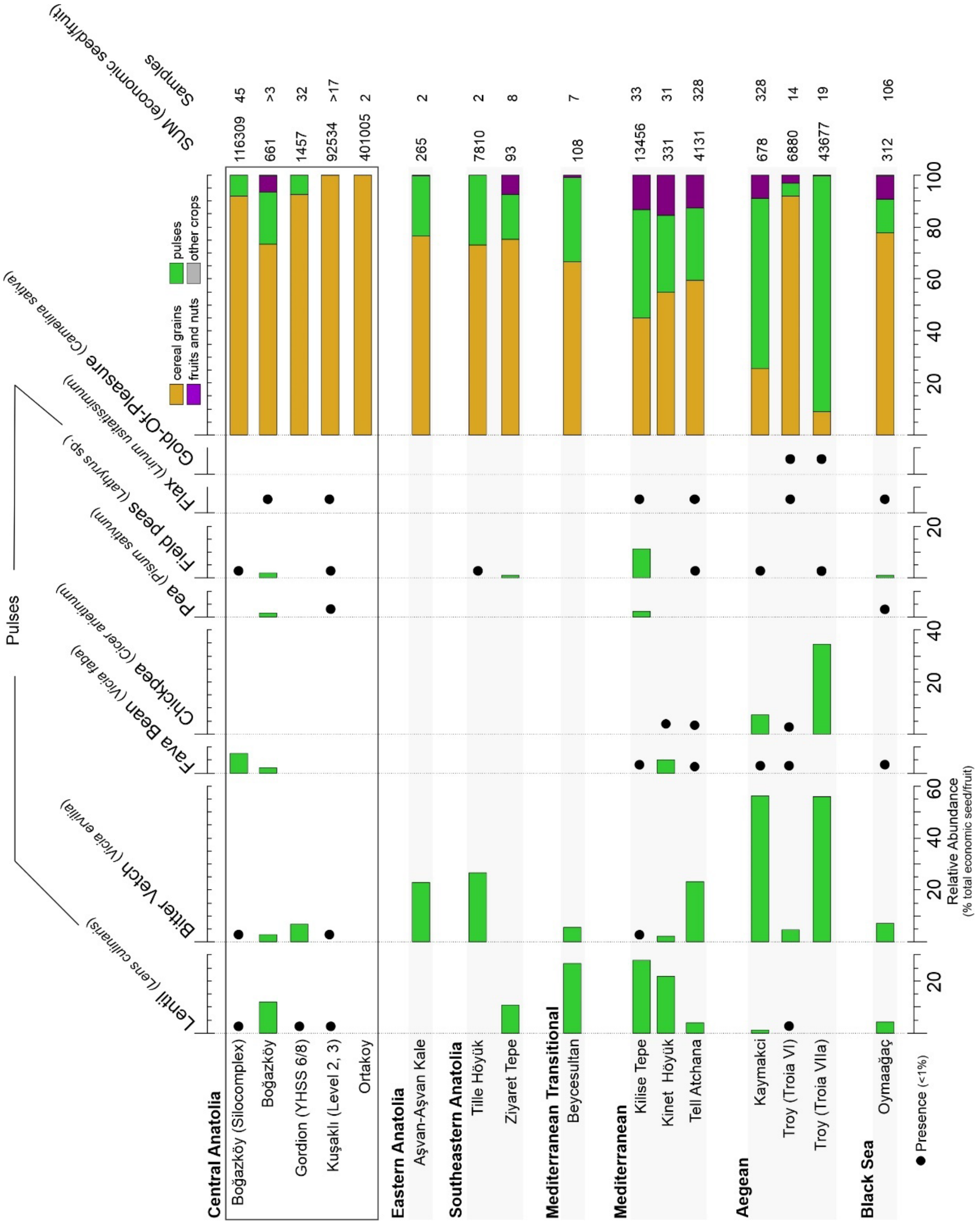


Figure 7.19 – *LBA archaeobotanical sequences: pulses and oilseeds. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum (see* Section 7.1*). Only assemblages with more than 50 selected economic seed/fruit remains are included.*

In general, it could be noted a more abundant attestation of pulses Boğazköy in comparison to other central Anatolian sites, which could be tentatively explained by the unique economic status of the Hittite capital. On the contrary, at other Anatolian sites (Gordion and Kuşaklı) pulses are attested in small quantities, with assemblages dominated by lentil and bitter vetch (Figure 7.19). Continuing previous trends, more abundant and taxonomically diversified assemblages are attested in the circum-Mediterranean region (Figure 7.19). Of particular note is the attestation in significant quantities of chickpea at the Aegean sites of Troy VIIa and Kaymakçı (Figure 7.19). The dominance of bitter vetch at both sites is partially driven by single concentrations (Riehl 1999, Shin et al 2021).

- *Fruits and nuts*

Important differences between central Anatolian and the circum-Mediterranean regions are documented also in fruits and nuts assemblages (Figure 7.20).

In central Anatolia, grape seeds are found in small quantities, at Boğazköy, Gordion, and Kuşaklı (Figure 7.20, Table 7.4). This apparently minor economic role of viticulture is in continuity with the trend observed in the previous periods (Section 7.3 and 7.4). In regard to fruit taxa, the Hittite capital is characterized by a richer and more diversified assemblage, which includes possible exotic crops (e.g., hazelnut). Imported was likely also an olive endocarp found at Ortaköy (Figure 7.20).

In contrast to the paucity of finds from the Anatolian Plateau, fruits and nuts are abundantly documented in the circum-Mediterranean region (Figure 7.20, Table 7.4). Grape and fig are particularly well-attested throughout this macro-region. I should single out the interesting discovery of entire fig syconia at LBA Kilise Tepe (Level IIIe), which included flattened specimens with a central hole, likely dry figs under processing (Bending and Colledge 2007: 592). More recent research has brough to light similar remains from the same architectural complex, the so-called Stele Building, which dates to the very end of the Late Bronze Age (Bouthillier et al. 2014: 131). Olive endocarps are abundantly attested at Tell Atchana, which would suggest that the Amuq represented an important olive farming region. *Olea* endocarps are, furthermore, documented at the Late Bronze Age sites of Kilise Tepe, Troy VIIa and Oymaağaç (Figure 7.20, Table 7.4).

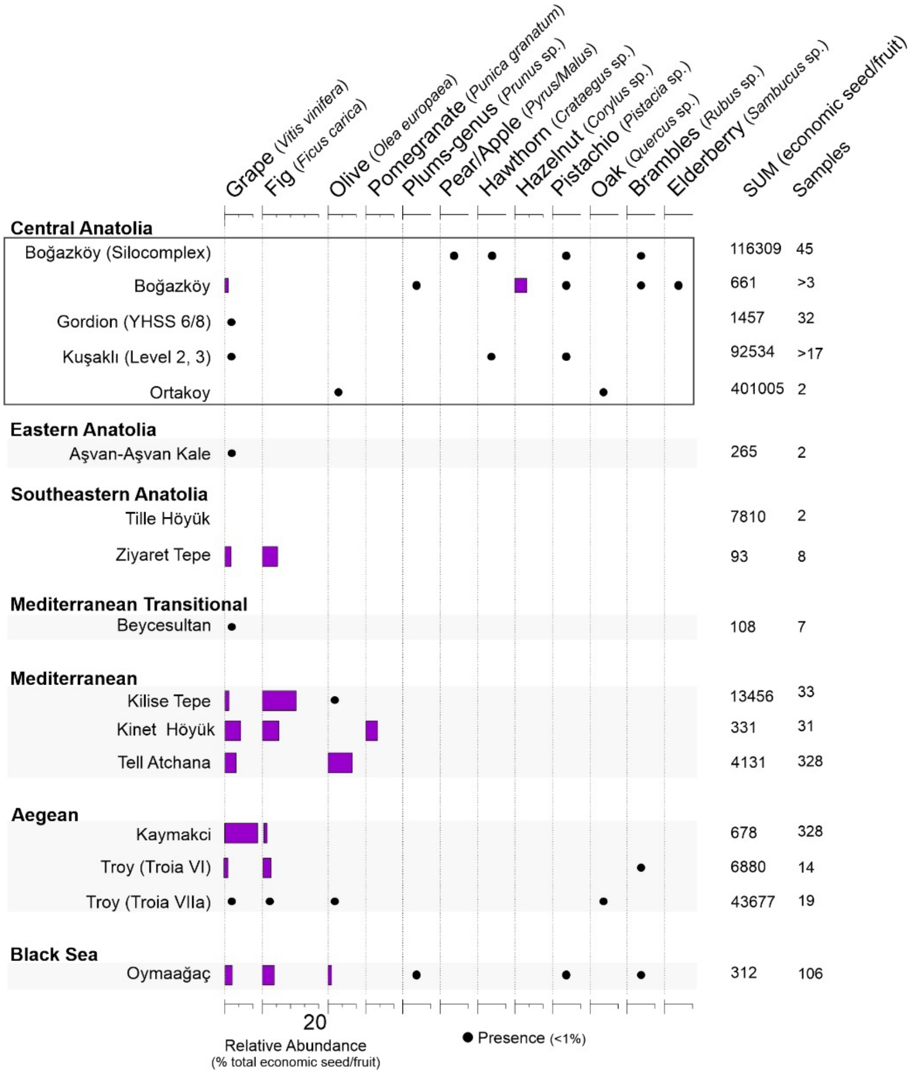


Figure 7.20 – *LBA archaeobotanical sequences: fruits and nuts. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum (see* Section *7.1). Only assemblages with more than 50 selected economic seed/fruit remains are included in the figure.*

A final note should be made in regard to the archaeobotanical remains from the late 14th century BCE shipwreck of Uluburun, which sunk offshore of Kas, in the Mediterranean coast of Turkey (see Section 2.1.3). Archaeobotanical analysis conducted on the cargo and associated debris returned a rich record of plants and plant-based products: 120 Canaanite jars containing terebinth resin; one Canaanite jar holding more than 2500 olive stones; more than one thousands pomegranate seeds from a large storage jar; thousands of fig seeds and a dozen of almond endocarps from the debris associated to the shipwreck (Haldane 1993). This evidence is not indicative of Anatolian agricultural production, given the likely Levantine origin of the cargo, yet it documents the inclusion of plant products in the broader Late Bronze Age Mediterranean trade network (Knapp 1991).

7.5.2 –*Staples productions and political economy in Hittite Anatolia* [36]

The Hittite empire is the first documented supraregional power in the history of central Anatolia (Section 1.2.3). In the 'Age of Diplomacy' (Liverani 2011), the Hittite great king sat with the rank of equal ("brother") at the table of the so-called Club of Great Powers – along with the Egyptian pharaoh, the kings of Babylonia, Assyria, and Mitanni. With the sole exception of Hatti, these Bronze Age western Asia political powers share a common characteristic: they are centered on important river systems – the Nile, Tigris, and Euphrates. Leaving aside any deterministic narrative (e.g., Wittfogel 1957), this geographic setting surely favored the production of comparatively sizeable and reliable agricultural surplus, which played a pivotal role in the economic basis of these polities. The core of the Hittite empire, on the contrary, extended on a landscape which could be regarded as particularly challenging to the establishment of a reliable and productive centralized agricultural system (e.g., Schachner 2022), as I will further discuss in the following paragraphs.

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[36] Parts of this section is taken verbatim from a forthcoming publication (Castellano, forthcoming), which originated in the context of the dissertation project.

Receiving on average between 280 and 400 mm of precipitation (see Section 1.1), cereal farming in the Anatolian Plateau is traditionally rain-fed. As I have already discussed in Section 2.3.1, in rain-fed systems the amount and distribution of precipitation occurring from October to March are crucial variables in determining yields: moisture at sowing correlates with higher germination rates (more grain-seeds that develop into plants), while spring rainfall enhance crop flowering and earing (more grains that are formed in each plant) (e.g., Sen et al. 2012). In short, the traditional Anatolian farming system chiefly relies on the timing and magnitude of the autumnal and spring storms (e.g., Sönmez et al. 2005), which in modern climatological sequences are characterized by having a rather hectic behavior (Figure 7.21). In its broader terms, the instability of central Anatolian climate is to be considered most likely not a prerogative of our days, but rather to be in large part characteristic of, at least, the later portion of the Holocene (Walker et al. 2019).

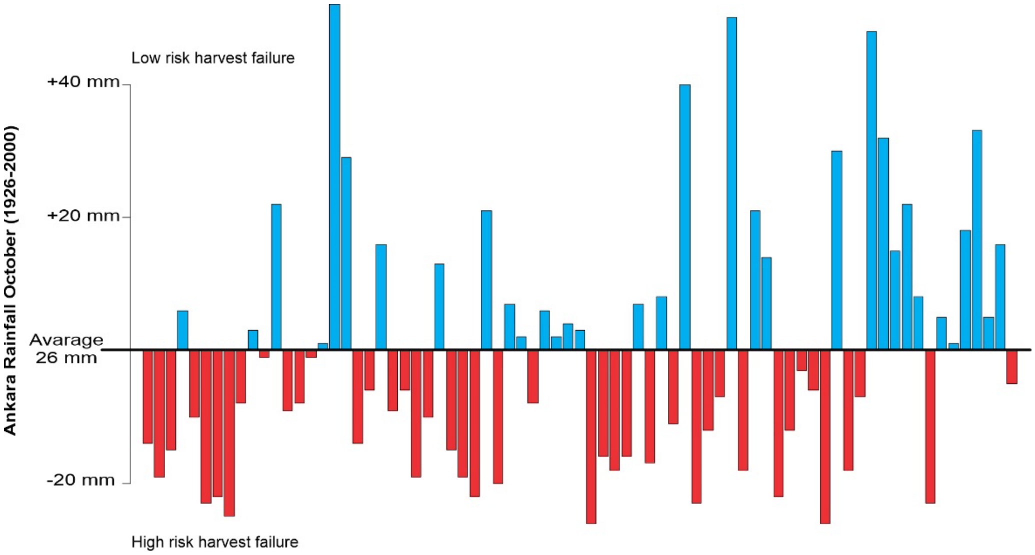


Figure 7.21 – Observed rainfall in Ankara in the month of October from 1926 to 2000. Years with below average values are in red (data from Çiçek 2003).

As noted, harvest failure or significantly lower yields are anticipated if the expected fall and spring rains do not occur, if they are significantly delayed, or if they occur in lower values than average. All those instances are well-known to modern Anatolian farmers, familiar with agricultural droughts occurring at relatively regular intervals (~5/10 years) (Sönmez et al. 2005). Several accounts from early modern Anatolia (e.g., Quataert 1968, White 2011, Ertem 2012 and 2017, Ayalon 2015) provide detailed accounts of catastrophic famines originating from harvest failures, which in turn were triggered by lower-than-average precipitation. Ancient Anatolia was certainly no exception to these issues, and ancient Anatolian farmers were surely well-aware of the importance of these seasonal storms. A good example in these regards, which I have already discussed in Section 2.3.2, comes from the Hittite 'Spring Festivals', directly associated to the success of the harvest and celebrated "*when spring comes, and it thunders*" (Cammarosano 2018: 39). Quoting the invocation that concluded the festival of the Storm God of the Rain in Ḫakmiš: "*O Strom God, my Lord, make rain plentiful! And make the dark earth satiated! And, o Storm God, let the loaves of bread become plentiful!*" (Cammarosano 2018: text no.13).

In addition to an unpredictability in agricultural production, a second limit imposed by the physical geography of central Anatolia is connected to its fragmented topography (Section 1.1). In such landscape, bulk trade over long distances is regarded as difficult and expensive (e.g., Schachner 2022). This latter assertation is well corroborated by early modern Anatolian historiographic accounts. Based on Ottoman sources, long-distance shipments of grains by means of pack or draft animals appears to have been economically unsustainable (Pamuk 1987). To provide an example, the price of wheat and barley produced in the region of Ankara tripled at their arrival in Istanbul, and a similar figure is reported for the shorter route from Erzurum to Trabzon (Quataert 1977: 144). It is only with the construction of the first railroads (in the 1890s), that central Anatolia districts will starts to export bulk quantities of grains to Istanbul and other external markets (Quataert 1977, Pamuk 1987). These structural difficulties in mobilizing grain surpluses likely represented an important challenge to pre-modern Anatolian economies. For instances, limiting the possibility to mitigate local and regional famines and seeds shortages by delivering grains from unaffected/richer areas.

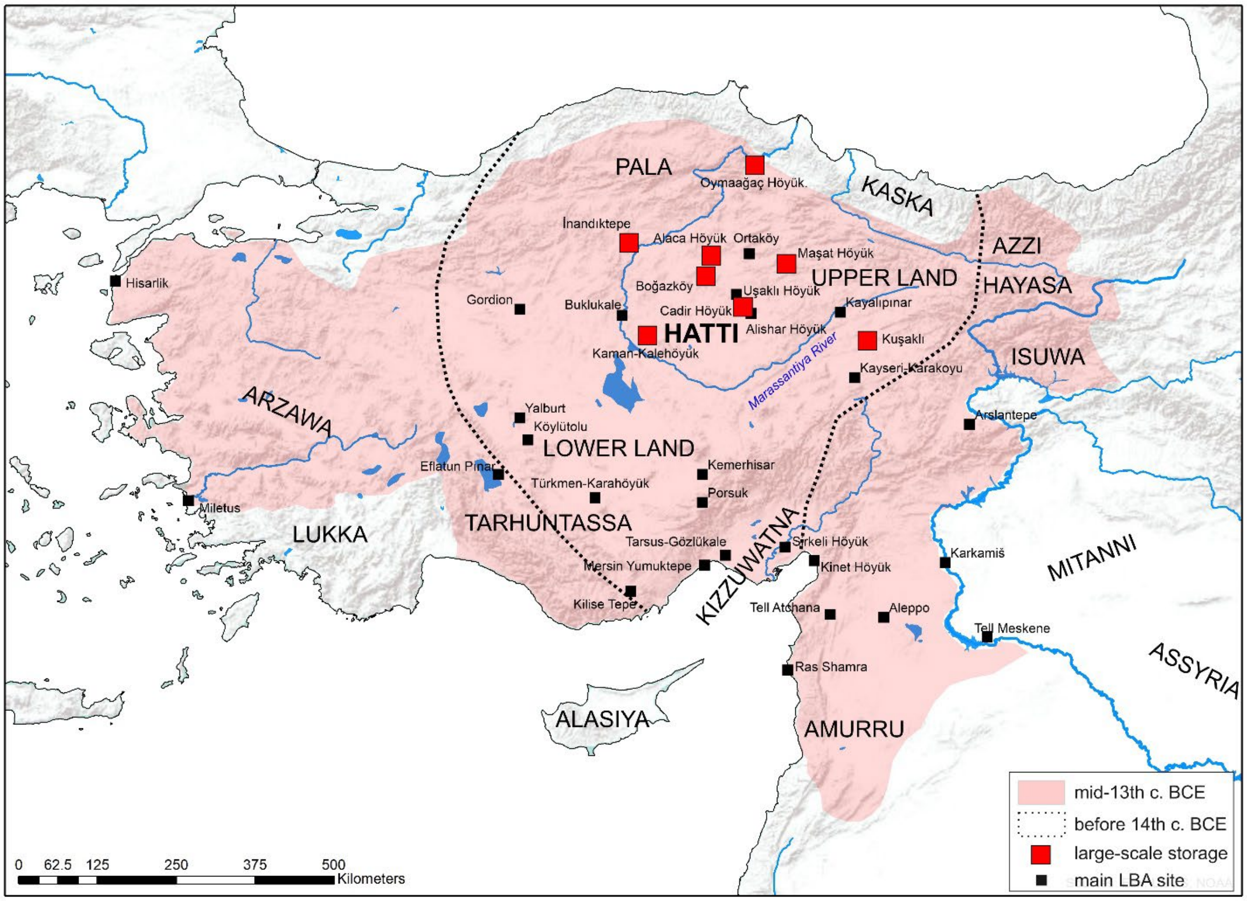
A third critical factor that underlies the fragility of Anatolian agriculture is associated to an endemic degree of conflictuality and political turmoil, possibly to some extent connected to cultural isolation promoted by the aforementioned topographic setting. The northern Anatolian population of the *Kaska* appears to have been particularly troublesome to the Hittite administration. The repercussion on agricultural production of the hostile activities conducted by the *Kaska* are very well-evidenced in the letters from the archive of Maşat Höyük: enemy raids often targeted agricultural fields and storerooms, which safety was often the prime concern of the Hittite administration – involving the entire political hierarchy, from local officials to the great king himself (Section 2.3.2).

In light of these considerations, a key question concerns how the Hittite polity actually succeeded in overcoming these structural limits. Andreas Schachner, the current director of the excavations at the Hittite capital city of Boğazköy-*Hattuša*, emphasized the role that a set of infrastructural and institutional innovations played in promoting and sustaining the establishment of the Hittite kingdom (e.g., Schachner 2017a, 2017b, 2017c, 2022). These innovations were directed towards stabilizing agricultural production and buffering the social and productive impact determined by fluctuations in grains availability. According to Schachner, these innovations allowed the Hittite polity to outgrowth the limits imposed by the physical geography of the Plateau, eventually promoting the establishment of the first supraregional power in the history of Anatolia (e.g., Schachner 2022).

- *Large-scale storage in Late Bronze Age central Anatolia*

Without rehashing here information already provided in Section 4.3.1, we can safely recognize in large-scale storage facilities a characteristic and distinctive feature of the 'Hittite city' (Mielke 2011: 176-178). Slightly different technical solutions are documented across central Anatolian sites (Figure 7.22), which have in common a skillful application of the anoxic grain storage principles. The latter allows for the long-term storage of bulk quantities of viable grains (Seeher 2000: 268). As I have already discussed in Chapter 4, these structures are not suitable for an episodic opening, being the success of the storage dependent on maintaining low levels of humidity and oxygen. Large-scale underground granaries, in these terms, could be understood as chiefly aimed at the long-term storage of bulk quantities of grains.

Late Bronze Age large-scale underground granaries are to date known from Boğazköy-*Ḫattuša* (11 silos on the hill of Büyükkaya, Seeher 2000: 270-278; 1 silo from the upper city, Schoop and Seeher 2006: 60361; the Silo-Complex in the Lower City, Seeher 2006), Alacahöyük (Çınaroğlu and Çelik 2010: 311-319), Oymaağaç-Nerik (Czichon et al. 2016: 38-41), Kaman-Kalehöyük Level IIIb (Fairbairn and Omura 2005), İnandıktepe Level III (Mielke 2006: 258-259), Kuşaklı-Sarissa (Mielke 2001: 237-240), and possibly Çadır Höyük (Gorny 2004: 18-19; Steadman and McMahon 2015: 93). Finally, a slightly different form of large-scale storage is attested in the Palace of Maşat Höyük-Tapikka (Özgüç 1978: 55). A more detailed discussion of these facilities and their chronology is provided in Section 4.3.1.


PALA
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Maşat Höyük
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Uşaklı Höyük
UPPER LAND
HAYASA
Hisarlik
Gordion
Buklukale
Cadir Höyük
Kayalıpınar
HATTI
Alishar Höyük
Kuşaklı
Kaman-Kalehöyük
Marassantiya River
Kayseri-Karakoyu
ISUWA
ARZAWA
Yalburt
Köylütolu
Arslantepe
LOWER LAND
Eflatun Pinar
Kemerhisar
Türkmen-Karahöyük
Porsuk
Miletus
LUKKA
TARHUNTASSA
Tarsus-Gözlükale
Sirkeli Höyük
Karkamiš
MITANNI
Mersin Yumuktepe
Kinet Höyük
KIZZUWATNA
Kilise Tepe
Tell Atchana
Aleppo
Tell Meskene
ASSYRIA
Ras Shamra
ALASIYA
AMURRU
mid-13th c. BCE
before 14th c. BCE
large-scale storage
main LBA site
0 62.5 125 250 375 500
Kilometers

Figure 7.22 – *Location of Late Bronze Age large-scale storage facilities. For references, see text. A more detailed discussion is provided in Section 4.3.1.*

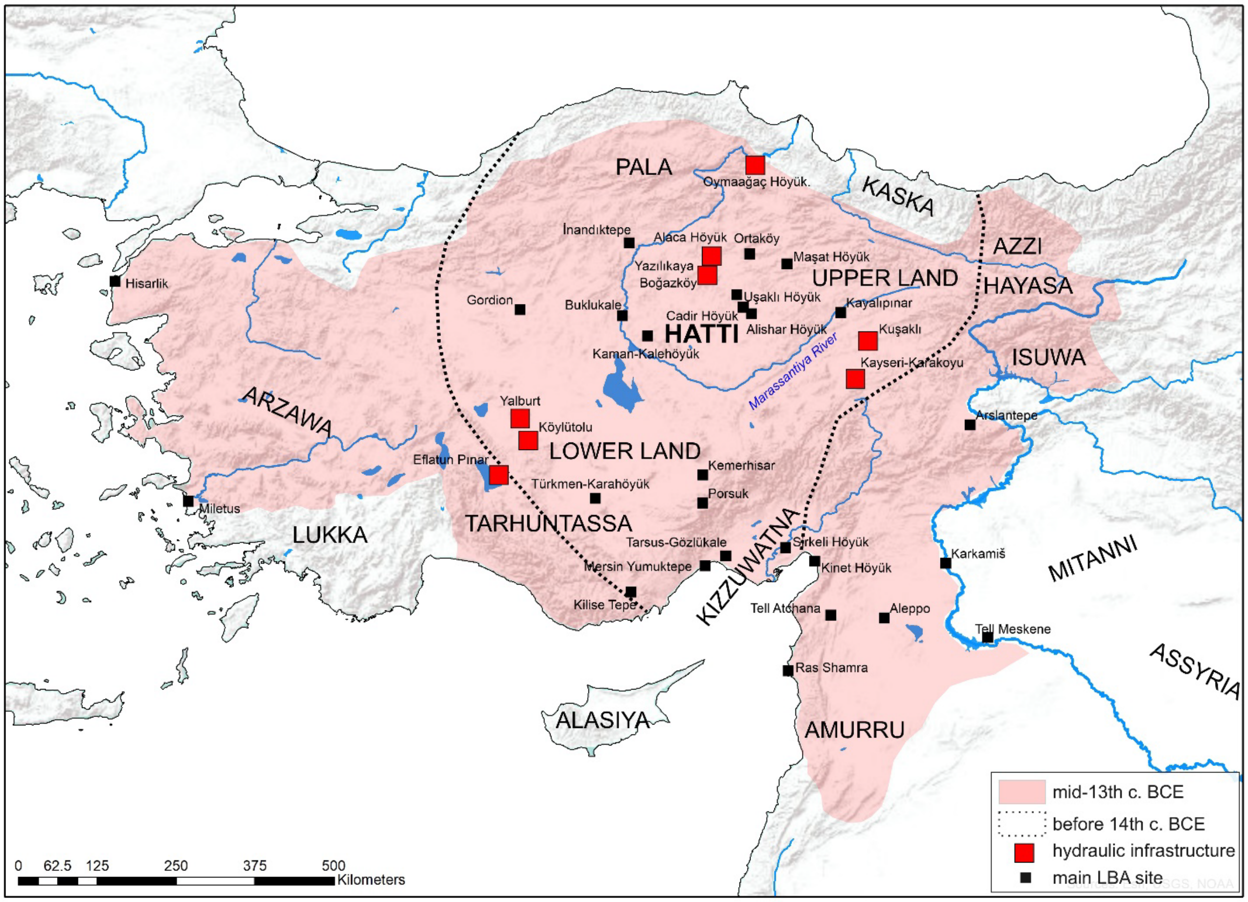
In central Anatolia, large-scale storage emerges as a distinctive feature of the Hittite kingdom, without any comparable example to date known from earlier periods (Section 7.3.2 and 7.4.2). Altogether, this evidence unequivocally indicates a central role that the management of agricultural products played in the Hittite political economy, starting from the very beginning of the Old Kingdom. The ability of the Hittite central power to extract and store large quantities of agricultural products might have played a crucial role in buffering the impact of short-term drought cycles and other disruptive events which affected grains availability. The stored staples could have represented emergency resources, to be used as foodstuff and/or grain-seeds during periods of shortages. Rather explicit examples in these regards can be found in the archive from the border town of Maşat Höyük-*Tapikka*, which I have discussed at length in Section 2.3.2. A group of letters from this archive informs on raids conducted by the *Kaska*, who plundered the fields in the region of *Tapikka*. In order to mitigate the resulting famine due to the lost harvest, the Hittite administration redistributed grains from the nearby storerooms, which were originally intended to be used for sowing (Section 2.3.2).

- *Hydraulic infrastructures in Late Bronze Age central Anatolia*

In addition to large-scale storage, water management represents a second key hallmark of the Late Bronze Age, Hittite, infrastructural landscape. These structures are known from the capital city Boğazköy-*Ḫattuša*, from several Hittite urban centers, and from sites located in the rural landscape (Figure 7.23).

Excavations conducted in the past 30 years at Boğazköy led to the identification of an articulated network of ponds, dams, and wells, in the city and its close environs. Within the city limits, the most remarkable evidence is from the so-called East (*Ostteiche*) and South (*Sudteiche*) ponds, two complexes of pools located in the upper town and filled by groundwater sources (Wittenberg and Schachner 2013). More recently, two large reservoirs were discovered through geophysical survey outside the walled city, about halfway between the outcrop of Büyükkaya and the extramural sanctuary of Yazılıkaya. A third reservoir has been tentatively located in their proximity, a few hundred meters to the north (Schachner 2017b: 40).

Three large water reservoirs were discovered at the site of Kuşaklı-*Sarissa* (Figure 7.24b), which were fed by runoff from the nearby mountains' slopes (Hüser 2006, 2007). A fourth hydraulic structure documented at Kuşaklı, a pond alimented by a spring, is located inside the walled area in proximity of the Northeast Gate. Hydraulic works were also identified in the broader landscape surrounding *Sarissa*, as shown by an artificial pond found within a mountain sanctuary located not far from the town (Hüser 2007). A third example of hydraulic infrastructure associated with a Hittite city comes from the hinterland of Alaca Höyük (Gölpınar) (Figure 7.24d), about 500 m southeast of the site (Çınaroğlu and Çelik 2010: 342-348). The dam defines a basin of about 100 x 110 m, filled by underground water sources. Finally, an underground stairway associated with a spring chamber has been recently discovered at Oymaağaç Höyük-*Nerik* (Czichon et al. 2019: 135-155).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Maşat Höyük
AZZI
UPPER LAND
HAYASA
Hisarlik
Gordion
Buklukale
Uşaklı Höyük
Kayalıpınar
Cadir Höyük
HATTI
Alishar Höyük
Kuşaklı
Kaman-Kalehöyük
Marassantiya River
Kayseri-Karakoyu
ISUWA
ARZAWA
Yalburt
Köylütolu
Arslantepe
LOWER LAND
Eflatun Pinar
Kemerhisar
Türkmen-Karahöyük
Porsuk
Miletus
LUKKA
TARHUNTASSA
Tarsus-Gözlükale
Sirkeli Höyük
Mersin Yumuktepe
Kinet Höyük
Karkamiš
MITANNI
KIZZUWATNA
Kilise Tepe
Tell Atchana
Aleppo
Tell Meskene
Ras Shamra
ASSYRIA
ALASIYA
AMURRU
mid-13th c. BCE
before 14th c. BCE
hydraulic infrastructure
main LBA site
0 62.5 125 250 375 500
Kilometers
USGS, NOAA

Figure 7.23 – *location of Late Bronze Age hydraulic infrastructures (ponds and damns). For references, see text.*

Water reservoirs and pools are also found in the rural landscape, at locations not associated with large urban sites (Figure 7.23). Well-known since decades are the highly monumentalized spring-fed ponds of Eflatunpınar (Figure 7.24c) (Mellaart 1962) and Yalburt Yailasi (Harmanşah et al. 2017: 315-319). Not far from those two pools, large-scale Hittite hydraulic work is documented at the earthen dam of Köylütolu Yayla (Harmanşah et al. 2017: 310-315). A similar dam is known also at Karakuyu, in the Pınarbaşı district of Kayseri (Figure 7.24a) (Emre 1993). It should be noted that three of these structures (Yalburt, Köylütolu, Karakuyu) are directly associated by epigraphic evidence to the Hittite great king Tudḫaliya IV, which reign dates to the last quarter of the 13th century (Section 1.2.3).

From this very concise overview, it appears evident that hydraulic infrastructures represented a characteristic and distinctive feature of the Hittite period, also in this instance without known precedents in the central Anatolian context.

What, then, was the function of such impressive structures? Without ruling out the possibility of a concomitant ritual use (e.g., Neve 1990, Erbil and Mouton 2012, Harmanşah 2020), there is large agreement in recognizing the predominant economic destination of these infrastructures (Schachner 2017a: 220, 2022: 184, Hüser 2006, 2007), as I will discuss bellow.

As previously noted, central Anatolian climate is characterized by a strong seasonality, which has direct repercussions on water availability and security throughout the year. On the plateau, most of the precipitation occurs from fall to spring (Section 1.1), causing an increase of the water table and overland runoff. Either by exploiting underground or surface water, these structures are designed to optimally store the water available during those months of positive hydrographic balance and to make this water available throughout the drier periods of the year. If welled water can be used for human consumption, it is expected that the water accumulated in most of these structures had a more direct use in agro-pastoral activities, such as livestock watering and irrigation.

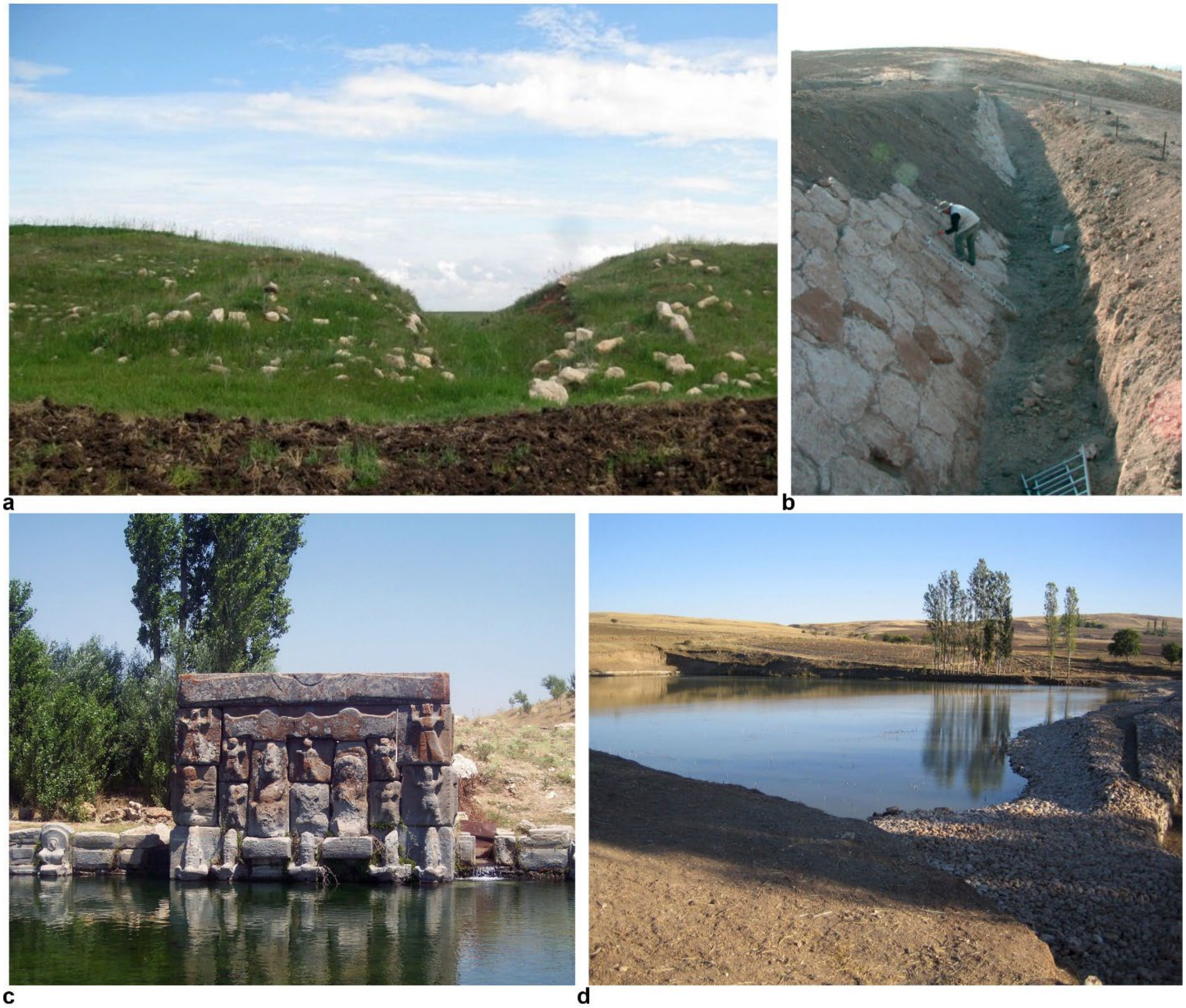

Figure 7.24 – *examples of Anatolian Late Bronze Age hydraulic infrastructures:* (*a*), *embankment of the Karakuyu dam;* (*b*), *stone-lined embankment of the dam of Kuşaklı-Sarissa under excavation;* (*c*), *spring-fed basin of Eflatunpınar;* (*d*), *reservoir of Gölpınar, near Alaca Höyük* (*images sources: a, c, d www.hittitemonuments.com; b,* Erkul et al. 2008).

The presence of canals and the irrigation of gardens and orchards in Hittite Anatolia are well-supported by textual sources, which have been reviewed in detail in Section 2.3.2. In the environmental context of the Anatolia Plateau, the irrigation of orchards is hardly surprising: fruit crops necessitates a degree of summer watering, considering the systematic presence of prolonged droughts during the hot season, which could jeopardize not just production but also the survival of the perennial plant itself. Hydraulic infrastructures, thus, might have promoted and secured an expansion in arboreal crops cultivation, possibly indicating a shift towards a long-term investment form of agriculture (Zohary et al. 2000: 114-116, Fuller and Stevens 2019) and a diversification in production.

More problematic is the question concerning the presence and extension of irrigated arable land. As already discussed in Section 2.3.2, the main textual source on these regards are the so-called *Feldertexte* (CTH 239. See Marazzi 2008). In these 'pseudo-cadastral' tablets it is made a distinction between *hatantijaš* and *šeššuraš* fields, which are translated as non-irrigated (literally dry) and irrigated plots (Marazzi 2008: 66). Šeššuraš-fields are also mentioned in the Hittite law §183/*69 (Hoffner 1997: 146). Considering the very limited evidence to date available, the possible occurrence of irrigation of cereal fields remains an open question.

Leaving open the question on irrigation of cereals in Hittite Anatolia, on a more general note, I shall emphasize the potential contribution of supplementary irrigation to rain-fed agricultural systems. Experimental data from central Anatolia (Ankara) indicates that it is possible to double the expected harvest by adding 50 mm of supplementary water at the sowing of otherwise fully rain-fed wheat (ICARDA 2003: 57). The significant increase in yields resulting from irrigation (either full or in supplementary form) is well-documented also in ethnographic data from pre-modern Anatolian. For example, Hillman (1973) provides yield values ranging from 630 kg/ha (rain-fed and non-manured) to 1100 kg/ha (irrigated) for traditionally farmed wheat plots in the region of Aşvan (Elazığ province). Supplementary irrigation of selected cereal fields could have, thus, potentially represented a determining factor in systematically increasing the yields, in addition to securing production during the cyclically expected drier years.

Interesting evidence on these regards have been recently published from the Silo-Complex of Boğazköy-*Ḫattuša*, a context that I have already discussed elsewhere in this chapter. Stable isotopes (13C and 15N) analysis conducted on emmer and barley indicates that the different chambers of the granary were filled with grains originating from distinct agricultural fields, defined by differences in growing conditions, which range from better watered and manured (chambers 12 and 32) to drier and low to medium manured (chambers 29 and 30) (Diffey et al. 2020: 1212-1214). Although the question of supplementary irrigation remains unanswered, the evidence from the Silo-Complex could more tentatively support the possibility that in addition to an expansion of the farmed land (see next section), the Hittite agricultural economy could have relied on some forms of more intensive management of selected plots, which was ultimately aimed at increasing land productivity and yields. Along these lines, following the model proposed by Wilkinson (1982), Schachner (2022: 172 and 180) hypothesized that the low-density ceramic scatters present in the surroundings of Boğazköy-*Ḫattuša* could be interpreted as resulting from a fertilization effort through the application of organic-rich waste.

In addition to irrigation and fertilization, soil productivity and yields can be increased by tillage, weeding, and following/crop rotation regimes (e.g., Palmer 1998). As already noted in Section 2.3.2, based on textual evidence (Instructions of the Frontier Post Governor, CTH 261.I; and Tablet HKM 109 from Maşat Höyük), Marazzi (2008) speculated about the possible presence in the Hittite agriculture of some forms of rotations between cereals and pulses. The evidence provided remains, however, to limited and conjectural to corroborate this hypothesis. More direct is the reference to tillage works, which is recurrent, for examples, in the Instructions of the Frontier Post Governor (Section 2.3.2).

- *The expansion of agricultural land in Hittite Anatolia*

If an increase in field productivity is difficult to achieve in pre-modern settings, a simpler strategy to increment agricultural surpluses is to expand the area under cultivation. In short, the more land is farmed the more crop is expected to be harvested. It is accordingly not surprising to find textual evidence indicating an effort of the Hittite administration to expand agricultural production. The feasibility of such expansion is dependent by the availability of four main resources: (*i*) land suitable for farming; (*ii*) grain-seeds that could be used for sowing; (*iii*) draft animals for plowing and tillage; and (*iv*) workforce involved in both farming and crop processing. Textual sources reviewed in Section 2.3.2 indicates a specific attention of the Hittite administration in maximize all these four critical aspects of agricultural economy, as I will further discuss below.

Important evidence on agricultural resources management in Hittite Anatolia is found in the Instructions for the Frontier Post Governor (Section 2.3.2). Among the main duties of this high official, it is reported that the frontier post governor shall keep a written record and properly allocate the available land plots, workforce, and grain-seeds: *"you must keep an eye on a deportee who has been settled* *in the province with regard to provisions, seed, cattle, (and) sheep; … Whoever remains in place of a deportee who leaves your province, though, you yourself must sow seed or him. Furthermore, he must be satisfied with regard to fields, so they shall promptly assign him a plot*" (§41); and furthermore "… *the fields of a run-away land tenant and land allotments that are empty shall be recorded for you. But when they allocate deportees, they shall promptly assign them a place*" (§47).

Arable land was doubtfully at scarcity in protohistoric Anatolia and the availability of grain-seeds could have been ensured and optimized by the storage network previously discussed. Labor, on the contrary, represented a resource of more difficult expansion (e.g., Schachner 2022: 182), assuming a slow pace of demographic growth characteristic of pre-modern societies. In order to expand the demographic basis, and as a consequence the workforce, ancient western Asian polities frequently adopted two main strategies: mass deportations and prisoners of war (Gelb 1973; more recently also Valk 2020 and Langer 2021). The Hittite kingdom was no exception to this pattern. For example, it is hardly a coincidence that in the deeds of the Hittite kings, a military victory is told to result in the deportation of the population and their mobile wealth, in the words of the great king himself: "*I burnt down the town, and I came away with deportees, cattle, sheep; and I brought them away to Ḫattuša*" (e.g., CTH 61).

Warfare represented an instrumental activity in order to retrieve workforce, which appears to have been systematically in shortage in Hittite Anatolia (de Martino 2022: 256, with further references). These already endemic demographic issues further precipitated during the late Empire period, likely exacerbated by the plague that decimated the Anatolian population in the second half of the 14th century BCE, which is most notably documented in a group of prayers attributed to Muršili II, (Singer 2002: 47-69). Concerns on demography are, furthermore, testified by the comparatively frequent inclusion in treaties of specific clauses concerning the return of runways and fugitives (Elgavish 2003, Beckman 2006b).

Considering that the availability of the workforce represented a critical variable in the central Anatolian agricultural economy, it is not surprising that households were bounded to land and included in royal donation deeds (Section 2.3.2) (Rüster and Wilhelm 2012). In short, human labor ultimately represented a resource that that was likely much more in shorter supply than arable land in Hittite Anatolia (Klingel 2022: 610-611).

To conclude this section, available evidence suggests that the successful establishment of the Hittite polity in central Anatolia could be partially associated to the development of a network of agricultural infrastructures and associated institutions, which ultimately allowed to outgrow some productive limits endemic to the Anatolian Plateau. Based on the available evidence, I have speculatively proposed that this system was based on three main strategies: (*i*) an expansion of the cultivated land, which was based on the maximalization of the available land, labor, and seed-reserves; (*ii*) a possible effort to increase productivity, which could have tentatively occurred through (supplementary) irrigation, manuring, and possibly other agronomic technique; and (*iii*) the establishment of buffering strategies aimed at limit the socio-demographic and productive impact of agricultural droughts, which were based on a network of large-scale long-term storage infrastructures and an administrative apparatus overseeing their functioning.

7.5.3 – *Considerations on the ‘Hittite’ crop assemblage*

In the previous sections, I have noted on several occasions that the centrality that agricultural production and management acquired in Hittite Anatolia relied on the successful introduction of a set of infrastructures and institutions, which appears to have been in discontinuity with the Early and Middle Bronze Age tradition. On the contrary, the crop assemblage from Late Bronze Age central Anatolia is in full continuity with the previous period. Limiting our considerations to cereals: hulled barley, emmer, and to a variable degree free-threshing wheat remained the backbone of central Anatolian farming.

A close degree of similarity is found between the assemblages from the capital city of Boğazköy-*Ḫattuša* and the provincial city of Kuşaklı-*Sarissa* (Figure 7.18, Table 7.4), the latter a site in which a strong Hittite imprint is documented in several aspects of the material culture – from architecture to ceramic productions (Müller-Karpe 2002). Conversely, significant differences are found in the coeval cereal record from Gordion, which is characterized by a minor contribution of hulled wheat, in favor of free-threshing wheat and in particular barley (Table 7.3, Figure 7.18). Given the available evidence, it is unclear whether the singularity of Gordion is indicative of a different degree of central control in agricultural production, a more pragmatic Hittite choice in maintaining a local farming tradition, or other reasons.

In Section 2.3.2, I have discussed the difficulties and uncertainties in translating the cereal phytonyms attested in the Hittite cuneiform sources. To keep this discussion short, I believe that a closer scrutiny of the archaeobotanical evidence does not allow to confirm a translation of the

Sumerogram ZÍZ as free-threshing (bread) wheat, which is commonly maintained in hittitological literature (e.g., Hoffner 1974 and 2001, del Monte 1995, Bolatti Guzzo 2006). On the contrary, an identification of the term as emmer, which is the standard translation in Mesopotamia proper, cannot be excluded a priori. In order to clarify this point, I shall return to the original argument proposed by Hoffner (1974: 65-69), on which much of the later literature is based. According to the author, a translation of ZÍZ as bread wheat can be argued on the basis of three main points: (*i*) ZÍZ is described in some texts as "pure" (*parkuiš*), which according to Hoffner could be connected to a free-threshing cultivar; (*ii*) this cereal is commonly used for bread-making; and (*iii*) it is the most attested cereal in the textual record, indicating that it represented the predominant wheat in Late Bronze Age central Anatolia. As a matter of fact, the considerations provided by the Hoffner (1974) could be very well counterargued in order to favor an alternative translation of the term ZÍZ as "emmer", more specifically: (*i*) "pure' could reasonably indicate a stage in processing, possible associated with either sifting or dehusking; (*ii*) the production of bread using emmer wheat is not problematic, given the presence of extensive experimental, archaeological, and archaeobotanical evidence in these regards (e.g., Samuel 1993, 1994); and (*iii*) based on archaeobotanical evidence, emmer appears to have been in Late Bronze Age central Anatolia as important, if not more important, than free-threshing wheat (Figure 7.18). This latter point has been further confirmed by recently published data from the Silo-Complex of Boğazköy-*Ḫattuša* (Diffey et al. 2020), which is coeval to the incipient phase of literacy at *Ḫattuša*. Given these considerations and pending additional textual and/or linguistic arguments, from an archaeobotanical standpoint, I would favor an agnostic position on this matter, opting for an unspecific translation of the term as generic "wheat".

7.5.4 – *The collapse of the Late Bronze Age agricultural landscape*[37]

The fall of Ḫattuša took place at the end of a decades-long phase characterized by political and military instability, on which much has been written (e.g., Singer 2000, 2009). In addition to these critical factors, the Hittite economic system appears to have suffered an important productive contraction, highlighted by several textual sources reporting famines affecting central Anatolia and Syria (Klengel 1974, Singer 1999, Divon 2008, Halayqa 2010, Knapp and Manning 2016). It appears, therefore, that the previously described agricultural system (Section 7.5.2) entered a phase of profound crisis, being in several documented instances no longer able to produce enough staples to fulfil the internal demands.

In Section 2.3.2, I have discussed the textual evidence concerning the shipments of large quantities of grains to Hatti during the final decades of the Empire. As I have already noted, the Hittite requests of grain deliveries are often framed in dramatic tones: "*I have no grain in my land*" wrote, for example, the Hittite queen Puduḫepa to the pharaoh Ramesses II (Edel 1994 I: 182-184). Broodbank (2013: 460-461) interpreted the textual evidence of shipments of grains from Egypt to the northern Levantine coast and Anatolia as signs of the establishment in the Eastern Mediterranean of an organized trade in staple products, seeing in those letters not evidence of crisis but rather of precocity. The possibility of a systemic movement of bulk goods in the inland regions of Anatolia has been already criticized (e.g., Van De Mieroop 2009: 138), considering the complexities of the Anatolian landscape causing such activities to be both highly impractical and anti-economic at best (see discussion in

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[37] Parts of this section is taken verbatim from a forthcoming publication (Castellano, forthcoming), which originated in the context of the dissertation project.

Section 7.5.2). It appears, thus, that a more direct interpretation of these sources (or at least part of them) is to be favored, which would lead to an indication of famines affecting the Anatolian Plateau and the eastern Mediterranean starting in the mid-13th century BCE and further precipitating in the following decades (Klengel 1974, Singer 1999, Knapp and Manning 2016). If this evidence is considered indicative of food shortages, why were Anatolians no longer able to produce their own foodstuffs?

A growing body of evidence indicates the presence of more arid conditions in the eastern Mediterranean basin and western Asia during the last centuries of the 2nd millennium BCE (Drake 2012; Finné et al. 2011, Roberts et al. 2011, Weiberg and Finné 2018), as part of a Holocene Rapid Climatic Change (RCC) event causing cooling of the poles and drying at the lower latitudes of the northern Hemisphere (Mayewski et al. 2004). A recent published high-resolution and well-dated speleothem from the Peloponnesus peninsula (Mavri Trypa; Weiberg and Finné 2018) provides important insights on the chronological development of this climatic phase in the Eastern Mediterranean: a wet phase characterizing the Late Bronze Age ended with an abrupt dry period centered at 1250 BCE and lasting two decades. After a short-lasting phase with relatively wetter conditions, to ca. 1225 BCE is dated the onset of a dry trend, which continues up to the end of the Mavri Trypa record (ca. 1000 BCE) (Weiberg and Finné 2018: 589). In agreement with this broader framework, paleoclimatic proxies from the Anatolian Plateau point to a generalized dry phase starting around the end of the Late Bronze Age and extending into the Early Iron Age. For instance, at Lake Tacer (in the Sivas province), a hiatus in the sedimentation is dated at ca. 1300-1100 BCE, indicating an important drying event of the lake (Kuzucuoğlu et al. 2011). A significant dry phase starting at ca. 1250 is further recorded in Cappadocia in the sequences of Eski Acıgöl and Nar Lake (Roberts et al. 2016).

As pointed out by Knapp and Manning (2016), a precise dating of the onset of this climatic phase remains a desideratum, and a chronological synchronization between paleoclimatic sequences and the historical record is consequently speculative at best. Weighting our considerations against this degree of chronological uncertainty, available evidence suggests that starting from the mid-13th century BCE the Hittite agricultural system was subjected to an important environmental stress caused by a sequence of drought events of high amplitude and frequency (sensu Dincauze 2010: 67-77). As a consequence, it is possible that the construction of reservoirs and storage-facilities registered an acceleration, perhaps reflecting an effort to expand the agro-pastoral infrastructural network in order to contain the productive and social effects caused by the changing environmental milieu. Considering the coeval evidence of food shortages, these interventions did not achieve the hoped-for results.

As previously discussed (Section 7.5.2), hydraulic infrastructures in central Anatolia functioned to stabilize water availability throughout the year, counteracting the inter-annual water deficit. Runoff and underground water available during the wettest seasons (fall to spring) could be collected and potentially made available for: (*i*) summer irrigation of orchards and vineyards, by using during the dry season the water accumulated during the wettest months of the year; (*ii*) in case of lower spring precipitations, the water accumulated in the previous fall and winter months could have potentially allowed for the irrigation of fields during the green-up and earing season (spring), crucial in determining the yield (Oates and Oates 1977: 122-124); (*iii*) in the eventuality the reservoir did not dry up by the end of the summer, irrigation of the fields at the sowing would had been possible, allowing for the increase/maintenance of the germination rate.

If those structures were fit to stabilize and raise production in a context of cyclically occurring droughts, then they were of little use in case of prolonged dry events. A sequence of drier years would in fact cause an abrupt and systematic lowering of the aquifer and runoff water, which would not be compensated for by sporadic rains. Available geomorphological evidence from natural basins, such as Tacer Lake (Kuzucuoğlu et al. 2011), indicates the occurrence of a sustained drying phase, with the lake deposits exposed to erosion. We might very reasonably consider that the same fate was shared by artificial reservoirs and basins. In those final attempts to secure water, design errors could have also occurred, as it has been proposed for the dam of Köylütolu (Harmanşah et al. 2017: 312).

Large-scale granaries were a successful measure for storing foodstuffs and seeding resources, to be used to buffer recurrent, yet not-continuous, years with low yields. Paralleling the case of hydraulic infrastructures, these facilities might have not been suitable for defending against the social and productive effects of prolonged years of harvest failure or low yields. To rely solely on large-scale storage to face long-term food shortages would have potentially been not just inefficient but also counterproductive. Centralized bulk storage would, in fact, mitigate the consequence of low yields in the short-term, without addressing the underlying productive deficit, ultimately slowing an effective response to the crisis and the deployment of effective agricultural strategies better suited to the new climatic and environmental scenario.

In short, in facing a new challenge, the Hittite central authority might have relied on those same strategies that allowed the polity to overcome the short-term environmental stress characteristic of the Anatolian Plateau in the first place. These strategies, which were previously successful in increasing production and in minimizing the effect of cyclically occurring droughts, could have been less effective in combatting the new climatic scenario defined by a long-term sequence of drought events of higher amplitude (Dincauze 2010: 67-77). By relying on traditional strategies, the central institutions did not develop new and effective protective measures, exacerbating the crisis and ultimately leading to the widespread famines and connected desperate requests for grain shipments. Thus, it could be proposed that in a time of crisis the Hittite polity failed in developing a successful strategy aimed at reacting against an external stress affecting foodstuff availability, a failure that perhaps resulted in the collapse of the economic system itself. These processes could be more in general considered indicative of an endemic lower degree of flexibility proper of imperial economies (Rosenzwieg and Marston 2018).

7.6 Agriculture in the Iron Age (1180-550 BCE): between continuities and discontinuities

The Iron Age corresponds to the time period comprised between the fall of the Hittite Empire (ca. 1180 BCE) and the Persian conquest of Asia Minor (550 BCE). As discussed in Section 1.2.4, this phase in Anatolian history is associated to a marked degree of cultural, ethnic, and political fluidity. Which agricultural landscapes are associated to this eventful historical phase?

7.6.1 *The Iron Age archaeobotanical record: an overview*

The archaeobotanical evidence dating to the Iron Age (IA) is summarized in Table 7.5. The cereal record is presented in Figure 7.25, pulses, oilseeds, and miscellaneous economic plant in Figure 7.26, and fruits-nuts in Figure 7.27. The methodology used is outlined in Section 7.1.

(Next page) Table 7.5 – *IA archaeobotanical sequences, for references see Section 2.1.3 and Appendix 1. If the sum of the specimens in a given group (cereals, pulses, etc.) exceed the cutoff value of 100, data are provided as relative abundances calculated using the group total as sum. On the contrary, abundances are reported using a semi-quantitative scale (*= 1, += 2 to 9, ++= 10 to 24, +++= 25 to 49, ++++= >49).*

	Period	Samples	NISP	Cereals											Pulses					
				Barley (*Hordeum vulgare*)	Naked Barley (*Hordeum vulgare* var. *nudum*)	Einkorn (*Triticum monococcum*)	Emmer (*Triticum dicoccum*)	Einkorn/Emmer (*T. monococcum/dicoccum*)	Free-Threshing Wheat (*Triticum aestivum/durum*)	Rye (*Secale cereale*)	Oat (*Avena* sp.)	Broomcorn Millet (*Panicum miliaceaum*)	Foxtail Millet (*Setaria italica*)	Millets (*Panicum/Setaria*)	Lentil (*Lens culinaris*)	Bitter Vetch (*Vicia ervilia*)	Fava Bean (*Vicia faba*)	Common Vetch (*Vicia sativa*)	Chickpea (*Cicer arietinum*)	Pea (*Pisum sativum*)
Central Anatolia																				
Gordion (YHSS 7)	EIA	78	7877.8	43%		4%	1%		52%	<1%			<1%		1%	99%				
Gordion (YHSS 6)	MIA	21	21500.1	82%		<1%	1%		17%				<1%		97%	1%			1%	
Gordion (YHSS 5)	MIA/LIA	43	415.1	59%					40%			1%	1%		++	+				
Kuşaklı (1b)	EIA	nr	489	25%		21%	25%		28%				1%		+	+++				+
Kuşaklı (1a)	MIA	nr	47	++		+	+		++						*					
Kınık Höyük (KH-P VB)	EIA	9	185.5	42%					41%			17%			+	+				
Kınık Höyük (KH-P VA)	EIA/MIA	10	280	47%			2%		49%			2%			+	++				
Kınık Höyük (KH-P IV)	MIA/LIA	31	614	48%	2%	1%	<1%		49%			1%			++	+			*	
Kerkenes	LIA	72	944	6%			1%		92%						+	+				
Eastern Anatolia																				
Sos Höyük	EIA	1	729	2%					98%						*					
Patnos	MIA/LIA	8	1794890148	2%			31%		67%						+	++				
Ayanis	LIA	81	7775423	37%					<1%	<1%		<1%	<1%	63%						*
Yoncatepe	MIA/LIA	25	1555836	98%			<1%		2%	<1%					99%	<1%			<1%	
Southeastern Anatolia																				
Ziyaret Tepe	EIA	4	178	++++		*			+						+					*
Ziyaret Tepe	MIA/LIA	100	2872	91%		2%	3%		3%	<1%			<1%		17%	41%	1%	2%	1%	37%
Tille Höyük	MIA	14	389688	<1%		<1%		<1%	<1%				99%		<1%	91%	<1%		<1%	9%
Karkemish	LIA	4	30	*																
Zeviya Tivilki	IA	24	167													100%				
Mediterranean																				
Tell Tayinat	EIA	54	1175	34%		1%	17%		48%						++++		*			+
Sirkeli	EIA/MIA	32	202	7%		3%			90%						+	+				
Kinet Höyük	MIA	2	23						++						*					
Kilise Tepe	IA	11	319	51%		21%	1%	1%	17%			9%			+	+	*			+
Aegean																				
Troy (Troia VIIb)	EIA	24	2723	92%		1%	4%	1%				1%			4%	93%	<1%		1%	
Troy (Troia VIII)	MIA/LIA	3	58	++			+									+	+			
Miletus	LIA	46	44818	78%		1%			4%			16%			++	+				
Daskeleion	LIA	1	26																	
Marmara Transitional																				
Ayazmaçukur	MIA	1	50	*		*			+			+								
Black Sea																				
Oymaağaç	IA	170	18691	97%	<1%	<1%	<1%	<1%	2%	<1%	<1%	1%			++	+++	++			+

	Period	Field Peas (*Lathyrus* sp.)	Fruits and Nuts																Oilseeds and Varia	
			Grape (*Vitis vinifera*)	Fig (*Ficus carica*)	Olive (*Olea europaea*)	Pomegranate (*Punica granatum*)	Hezelnut (*Corylus* sp.)	Almonds (*Amygdalus* sp.)	Plums-genus (*Prunus* sp.)	European Plum (*Prunu domestica*)	Pear/Apple (*Pyrus/Malus*)	Hawthorn (*Crataegus* sp.)	Hackberry (*Celtis* sp.)	Cornelian Cherry (*Cornus mas*)	Pistachio (*Pistacia* sp.)	Pine (*Pinus* sp.)	Brambles (*Rubus* sp.)	Elderberry (*Sambucus* sp.)	Flax (*Linum usitatissimum*)	Gold-of-Pleasure (*Camelina sativa*)
Central Anatolia																				
Gordion (YHSS 7)	EIA		*					*												
Gordion (YHSS 6)	MIA							*											100%	
Gordion (YHSS 5)	MIA/LIA		+	+				*												
Kuşaklı (1b)	EIA	*																		
Kuşaklı (1a)	MIA																			
Kınık Höyük (KH-P VB)	EIA			+								*								
Kınık Höyük (KH-P VA)	EIA/MIA		+									++					*			
Kınık Höyük (KH-P IV)	MIA/LIA		++++	*															*	
Kerkenes	LIA								*					++++						
Eastern Anatolia																				
Sos Höyük	EIA		*													*				
Patnos	MIA/LIA	+																		
Ayanis	LIA																			
Yoncatepe	MIA/LIA		+																	100%
Southeastern Anatolia																				
Ziyaret Tepe	EIA		++++																++	
Ziyaret Tepe	MIA/LIA	2%	53%	45%						1%			1%							
Tille Höyük	MIA	<1%	100%																100%	
Karkemish	LIA		+++		+															
Zeviya Tivilki	IA																			
Mediterranean																				
Tell Tayinat	EIA		50%	42%	8%										<1%				++	
Sirkeli	EIA/MIA		++	+	*															
Kinet Höyük	MIA		+																	
Kilise Tepe	IA	+	37%	54%	1%	8%														
Aegean																				
Troy (Troia VIIb)	EIA	1%	++	++++							*						+		+	++
Troy (Troia VIII)	MIA/LIA		*	++																
Miletus	LIA	*	<1%	99%	1%	<1%	<1%													
Daskeleion	LIA	+++																		
Marmara Transitional																				
Ayazmaçukur	MIA		++	*								*					++	+		
Black Sea																				
Oymaağaç	IA	++	++	++++	+					+							*			

	Period	Safflower (*Carthamus tinctorius*)	Coriander (*Coriandrum sativum*)	Celery (*Apium graveolens*)	Caraway (*Carum carvi*)	Carrot (*Daucus carota*)	Parsley (*Petroselinum crispum*)	Sesame (*Sesamum indicum*)
Central Anatolia								
Gordion (YHSS 7)	EIA							
Gordion (YHSS 6)	MIA							
Gordion (YHSS 5)	MIA/LIA							
Kuşaklı (1b)	EIA							
Kuşaklı (1a)	MIA							
Kınık Höyük (KH-P VB)	EIA							
Kınık Höyük (KH-P VA)	EIA/MIA							
Kınık Höyük (KH-P IV)	MIA/LIA		*					
Kerkenes	LIA							
Eastern Anatolia								
Sos Höyük	EIA							
Patnos	MIA/LIA							
Ayanis	LIA		34%		33%		3%	
Yoncatepe	MIA/LIA							
Southeastern Anatolia								
Ziyaret Tepe	EIA							
Ziyaret Tepe	MIA/LIA	++++				+		+
Tille Höyük	MIA							
Karkemish	LIA							
Zeviya Tivilki	IA							
Mediterranean								
Tell Tayinat	EIA		+					
Sirkeli	EIA/MIA							
Kinet Höyük	MIA							*
Kilise Tepe	IA							
Aegean								
Troy (Troia VIIb)	EIA							
Troy (Troia VIII)	MIA/LIA							
Miletus	LIA			+				
Daskeleion	LIA							
Marmara Transitional								
Ayazmaçukur	MIA							
Black Sea								
Oymaağaç	IA					*		

The archaeobotanical study conducted at Niğde-Kınık Höyük provides a new reference sequence from central Anatolia, spanning from the late 2nd to the end of the 1st millennium BCE. More specifically, to the Iron Age (see Section 3.4.3) are attributed materials sampled from Period KH-P VB (ca. 1180-1000 BCE; 9 samples), KH-P VA (ca. 1000-800 BCE; 10 samples), and KH-P IV (ca. 800-500 BCE; 31 samples). For a more detailed presentation and discussion of the anthracological and carpological evidence from the site, I refer respectively to Chapter 5 and 6. In addition to the dataset from Niğde-Kınık Höyük, a second key archaeobotanical sequence covering the entire Iron Age is available from Gordion (Miller 2010, Marston 2017). Elsewhere in central Anatolia, carpological research is published from the Early Iron Age and Middle Iron Age levels of Kuşaklı (Müller-Karpe et al. 1998), and from the

Late Iron Age site of Kerkenes (Marston and Branting 2016, Smith and Branting 2014).

- *Cereal assemblages*

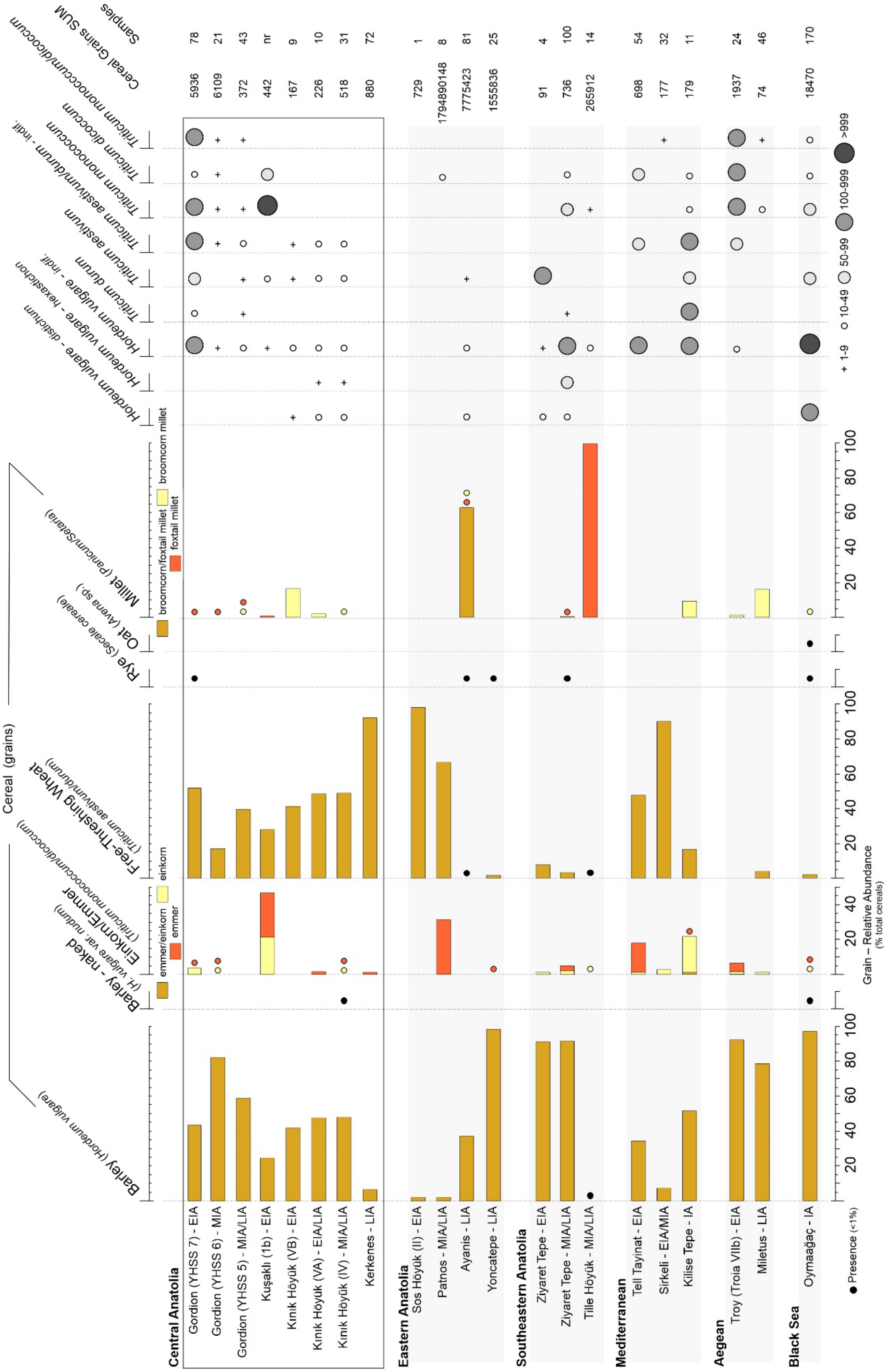
Starting this overview from cereals, I shall first highline some general trends which emerging from the central Anatolian dataset. Hulled wheats are replaced by free-threshing cultivars at most sites, with only singular exceptions dating to the Early Iron Age (Figure 7.25). The ratio between barley and free-threshing wheat varies across sites, possibly hinting to regional preferences which could be in turn explained in terms of ecological differences – e.g., moisture availability. By the beginning of the Iron Age, millet likely gained a degree of economic importance in central Anatolian farming, given its ubiquitous occurrence, although in small quantities (Figure 7.25).

The cereal record from the Early Iron Age levels of Kuşaklı clearly stands as distinct from the coeval central Anatolian assemblages (Figure 7.25). In comparison to LBA samples from the same site, hulled wheats are found more abundantly, especially einkorn – which was previously attested only by single specimens. The latter taxon is abundantly attested both in form of grains and chaff remains. Although in a different magnitude, an increase in einkorn has been documented also during the Early Iron Age at Gordion (YHSS 7) (Figure 7.25). The increase in einkorn at Gordion, which is also in this case attested by both grains and chaff, is singular throughout the well-sampled and long archaeobotanical sequence from the site. A third, and final EIA, archaeobotanical assemblage originates from Niğde-Kınık Höyük (KH-P VB) (Chapter 6). Despite the comparatively limited number of samples, the cereal record from this latter site appears distinct from both Gordion and Kuşaklı: hulled wheat are not attested, in favor of free-threshing wheat (likely *Triticum aestivum* s.l. on the basis of rachis fragments) and hulled barley. Furthermore, at EIA Kınık Höyük, broomcorn millet appears to have had a greater importance (Figure 7.25).

Following the aforementioned uptick during the Ealy Iron Age, hulled wheats fall out of economic importance in central Anatolia agriculture from the beginning of the 1st millennium BCE onwards, as documented at Gordion (YHSS 6 and 5) and Kınık Höyük (KH-P VA and KH-P IV) (Figure 7.25). Hulled barley and free-threshing wheat are the two predominant cereals at both sites. Evidence from MIA Kuşaklı is too limited to allow quantitative considerations, nevertheless also at this latter site it is recorded a decrease in importance of hulled in favor of free-threshing wheats (Table 7.4).

If cereal farming at both Gordion and Kınık Höyük was based on hulled barley and free-threshing wheat, important differences between the two sites are recorded in terms of ratio between these two crops (Figure 7.25). More specifically, free-threshing wheat is significantly more abundantly found at the site of Kınık Höyük. This trend will become even more pronounced during the second half of the millennium (Section 7.7). As I will discuss further later in this section, important differences between the two sites are recorded also in regard to the fruit and nut assemblages, strongly suggesting the presence of two well-distinct agricultural systems.

Late Iron Age evidence is finally available from the Phrygian site of Kerkenes – a short lived (ca. 600-540 BCE), large-scale, urban site located in the Yozgat province (Section 1.2.4). The cereal assemblage at the site appears to have been atypically dominated by free-threshing wheat over barley (Figure 7.25), which has been reconducted by Marston and Branting (2016) to the presence of wetter conditions in the environs of the site.


Cereal (grains)
Barley (Hordeum vulgare)
Barley - naked (H. vulgare var. nudum)
Einkorn/Emmer (Triticum monococcum/dicoccum)
Free-Threshing Wheat (Triticum aestivum/durum)
Rye (Secale cereale)
Oat (Avena sp.)
Millet (Panicum/Setaria)
Hordeum vulgare - distichum
Hordeum vulgare - hexastichon
Hordeum vulgare - indif.
Triticum durum
Triticum aestivum
Triticum aestivum/durum - indif.
Triticum monococcum
Triticum dicoccum
Triticum monococcum/dicoccum
Cereal Grains SUM
Samples
emmer/einkorn
emmer
einkorn
broomcorn/foxtail millet
foxtail millet
broomcorn millet
Central Anatolia
Gordion (YHSS 7) - EIA 5936 78
Gordion (YHSS 6) - MIA 6109 21
Gordion (YHSS 5) - MIA/LIA 372 43
Kuşaklı (1b) - EIA 442 nr
Kınık Höyük (VB) - EIA 167 9
Kınık Höyük (VA) - EIA/LIA 226 10
Kınık Höyük (IV) - MIA/LIA 518 31
Kerkenes - LIA 880 72
Eastern Anatolia
Sos Höyük (II) - EIA 729 1
Patnos - MIA/LIA 1794890148 8
Ayanis - LIA 7775423 81
Yoncatepe - LIA 1555836 25
Southeastern Anatolia
Ziyaret Tepe - EIA 91 4
Ziyaret Tepe - MIA/LIA 736 100
Tille Höyük - MIA/LIA 265912 14
Mediterranean
Tell Tayinat - EIA 698 54
Sirkeli - EIA/MIA 177 32
Kilise Tepe - IA 179 11
Aegean
Troy (Troia VIIb) - EIA 1937 24
Miletus - LIA 74 46
Black Sea
Oymaağaç - IA 18470 170
20 40 60 80 100
20 40
20 40 60 80 100
20 40 60 80 100
Grain – Relative Abundance (% total cereals)
● Presence (<1%)
+ 1-9 ○ 10-49 ○ 50-99 ○ 100-999 ● >999

(Previous page) Figure 7.25 – *IA archaeobotanical sequences: cereals. The graph is based on relative abundance calculated using the total of selected cereal grains as sum. Chaff is reported using a semi-quantitative scale. For further details see* Section 7.1. *Only assemblages with more than 50 cereal grains are included.*

Outside the Anatolian Plateau, leaving aside a single sample from EIA Sos Höyük, published evidence from the eastern highlands originates from Urartian fortresses: Patnos (ca. 827-725 BCE), Ayanis (ca. 685-645 BCE), and Yoncatepe (ca. 800-600 BCE) (Section 2.1.3). The presence of large storerooms, used for both liquid and grains, is a characteristic feature of these fortified sites, which is well documented in both the archaeological and textual record (e.g., Zimanski 1985: 73-75). Archaeobotanical research in eastern Anatolia targeted these storing facilities. Quantitative data from these sites are accordingly to be cautiously evaluated, due to their origin from large concentrations of pure caches of grains. In addition to the expected occurrence of both barley and free-threshing wheat, worth of note is the presence of large stores of emmer (Patnos) and millets (Ayanis) (Figure 7.25). It appears, thus, that hulled wheat (emmer) was locally farmed in Eastern Anatolia during the Middle Iron Age, in contrast to the central Anatolian sites of Gordion and Kınık Höyük.

In southeastern Anatolia, intensive archaeobotanical research has been conducted at the Neo-Assyrian levels of Ziyaret Tepe (Tigris Valley), and in a more limited extent at the roughly coeval levels from Tille Höyük (Euphrates Valley). The evidence from Karkemish and Zeviya Tivilki is here not considered, given the paucity of cereal remains at both sites (Table 7.5). A large store of foxtail millet (*Setaria italica*) found at Tille Höyük supports the cultivation of this summer crop during the Neo-Assyrian period in the Middle Euphrates Valley. The cereal record from the more intensively studies site of Ziyaret Tepe appears in continuity with the previous Bronze Age farming tradition: barley is predominant, with wheat occurring only in very minor quantities (Figure 7.25). In the chaff record from Ziyaret Tepe, it is recorded a comparatively abundant attestation of 6-row barley. Given the moisture requirements of poly-rowed cultivars (Harlan 1968), it could be hypothesized that it was either cultivation as forage crop or farmed under an irrigated regime. Considering that also millet likely requires a degree of artificial watering (Miller et al. 2016), the latter hypothesis would tentatively suggest a more generalized expansion of irrigation in southeastern Anatolia under Neo-Assyrian control.

In the Mediterranean region, published research is available from the EIA levels of Tell Tayinat (Amuq), EIA/MIA strata from Sirkeli Höyük (Plain Cilicia), and Kilise Tepe (Rough Cilicia) (Section 2.1.3). Evidence from Kinet Höyük dating to the Iron Age is too limited to allow quantitative considerations. The interpretation of the Iron Age records from this region is particularly challenging: each published site is, in fact, characterized by a very distinctive cereal assemblage (Figure 7.25). More data are necessary in order to investigate whether or not these differences are indicative of actual chronological and/or geographic trends.

The EIA assemblage from Tell Tayinat is characterized by a comparatively importance of emmer, which together with barley and free-threshing wheat dominates the record. On some regards, this pattern from Tell Tayinat recalls the late 3rd millennium BCE record from the site (Section 7.3), prior to the occupation hiatus during the Middle and Late Bronze Age. On the contrary, significant differences are found in comparison to the cereal record from the nearby Late Bronze Age site of Tell Atchana (Section 7.4), located less than a kilometer to the southeast of Tayinat.

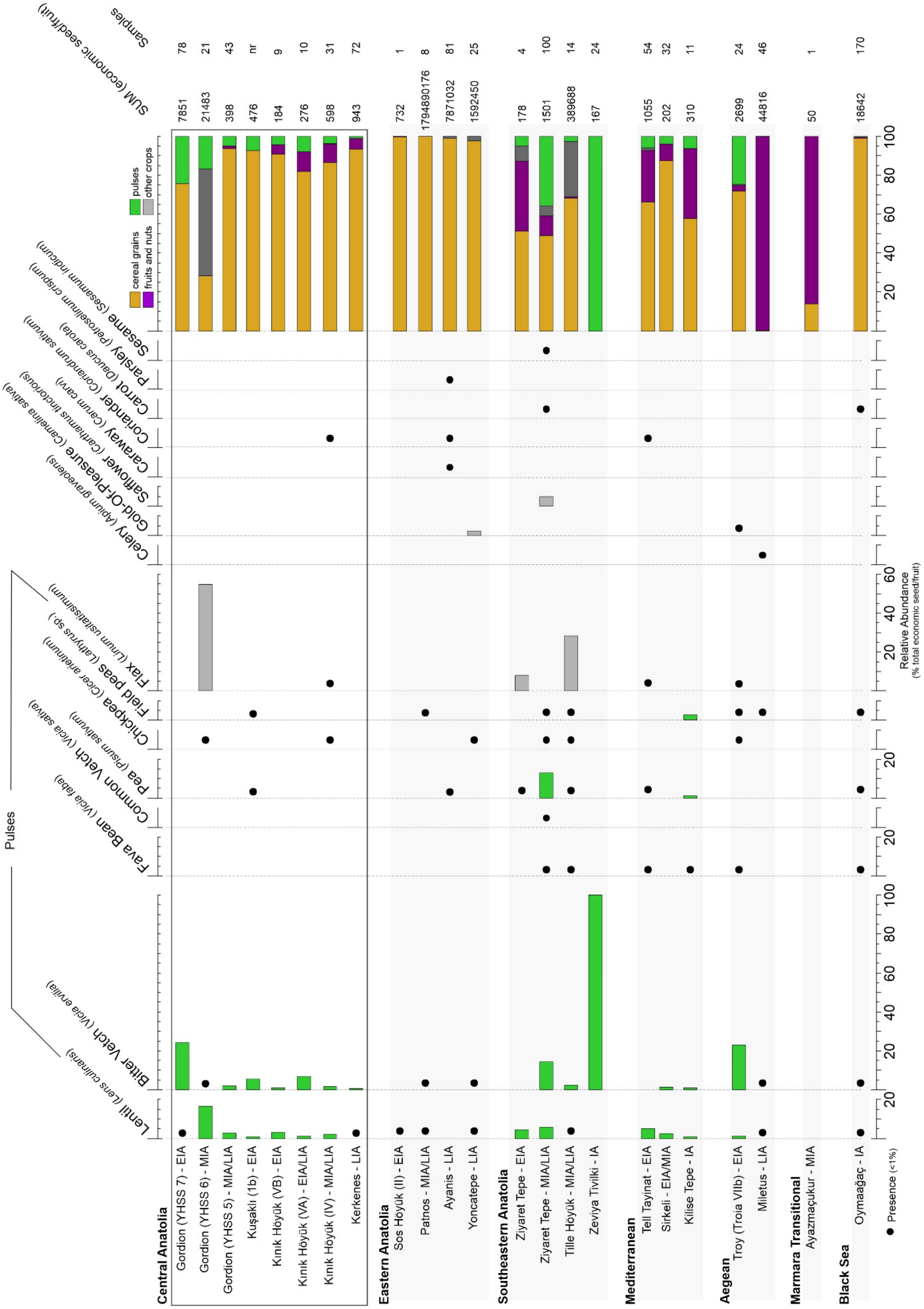
The cereal record from Kilise Tepe is in continuity with the previous phase. The site remains singular in the regional context, given the atypical abundance of einkorn (Figure 7.25). More recent research conducted at Kilise Tepe, which is not yet fully published, appears to further confirm the importance of einkorn at the site (Bouthillier et al. 2014: 131). Finally, at Sirkeli Höyük, in Plain Cilicia, it is recorded a predominance of free-threshing wheat, followed by barley, and with only a minor contribution of hulled wheats (Figure 7.25).

On the Aegean coast, published evidence is available from Troy (VIIb; ca. 1180-900 BCE) and from the archaic levels at Miletus. Cereal assemblages form both sites are dominated by barley. It appears that hulled wheats, in particular emmer, continued to have a degree of importance (Figure 7.25). Evidence from Troy VIII (ca. 900-650 BCE) and from archaic levels at Daskeleion is too limited to warrant any meaningful quantitative consideration (Table 7.5).

Finally, on the Black Sea, archaeobotanical research has been conducted at the site of Oymaağaç. This record, dominated by barley, has been only preliminary published, with a general attribution to the Iron Age, (Figure 7.25). Pending full publication, a more detailed interpretation of this sequence remains to date challenging.

- *Pulses, oilseeds, spices, and herbs*

Moving to pulses, the pattern documented in central Anatolia during the previous periods remains in place: the sites on the plateau are characterized by a taxonomically and quantitatively limited assemblage, which is dominated by lentil and bitter vetch (Figure 7.26). Other taxa, such as pea and chickpea, occur only as single specimens (Figure 7.26), which would suggest their likely marginal role in the regional farming system, already note in previous sections.


Central Anatolia
Gordion (YHSS 7) - EIA
Gordion (YHSS 6) - MIA
Gordion (YHSS 5) - MIA/LIA
Kuşaklı (1b) - EIA
Kınık Höyük (VB) - EIA
Kınık Höyük (VA) - EIA/LIA
Kınık Höyük (IV) - MIA/LIA
Kerkenes - LIA
Eastern Anatolia
Sos Höyük (II) - EIA
Patnos - MIA/LIA
Ayanis - LIA
Yoncatepe - LIA
Southeastern Anatolia
Ziyaret Tepe - EIA
Ziyaret Tepe - MIA/LIA
Tille Höyük - MIA/LIA
Zeviya Tivilki - IA
Mediterranean
Tell Tayinat - EIA
Sirkeli - EIA/MIA
Kilise Tepe - IA
Aegean
Troy (Troia VIIb) - EIA
Miletus - LIA
Marmara Transitional
Ayazmaçukur - MIA
Black Sea
Oymaağaç - IA
● Presence (<1%)
Pulses
Lentil (Lens culinaris)
Bitter Vetch (Vicia ervilia)
Fava Bean (Vicia faba)
Common Vetch (Vicia sativa)
Pea (Pisum sativum)
Chickpea (Cicer arietinum)
Field peas (Lathyrus sp.)
Flax (Linum usitatissimum)
Celery (Apium graveolens)
Gold-Of-Pleasure (Camelina sativa)
Safflower (Carthamus tinctorius)
Caraway (Carum carvi)
Coriander (Coriandrum sativum)
Carrot (Daucus carota)
Parsley (Petroselinum crispum)
Sesame (Sesamum indicum)
cereal grains
fruits and nuts
pulses
other crops
SUM (economic seed/fruit)
Samples
7851
21483
398
476
184
276
598
943
732
1794890176
7871032
1592450
178
1501
389688
167
1055
202
310
2699
44816
50
18642
78
21
43
nr
9
10
31
72
1
8
81
25
4
100
14
24
54
32
11
24
46
1
170
20
20
40
60
80
100
20
20
20
40
60
Relative Abundance
(% total economic seed/fruit)
20
40
60
80
100

(Previous page) Figure 7.26 – *IA archaeobotanical sequences: pulses and oilseeds. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum* (*see* Section *7.1*). *Only assemblages with more than 50 selected economic seed/fruit remains are included.*

Due to sampling targeting large storage areas, not much could be said in regard to pulse farming in eastern Anatolia. The quantitatively modest attestation of these crops at Urartian sites (Figure 7.26) could very likely represent a result of the sampling strategies in place. Taxonomically diverse pulses assemblages are documented in southeastern Anatolia and in the circum-Mediterranean regions. Both fava bean and pea are ubiquitously found across sites in this macro-region, supporting their far greater role in this geographic and cultural ambit. The dominance of bitter vetch at Zeviya Tivilki is quantitatively unrepresentative, given the origin of the specimens from a single pure concentration of this crop.

Of note is an apparent increased importance of flax, which includes concentrations found in the Early Phrygian destruction level at Gordion, Early Iron Age levels at Ziyaret Tepe, and the Neo-Assyrian occupation of Tille Höyük (Figure 7.26). Finally, to be briefly mentioned is the attestation of large concentrations (not visible in figure 7.26 due to the very high specimen count at the site) of caraway (*Carum carvi*), coriander (*Coriandrum sativum*), and parsley (*Petroselinum crispum*) in a destruction level context from the site of Ayanis, in eastern Anatolia (Table 7.5). These remains were found scattered on the floor of a building destroyed during a conflagration, likely originally stored in ceramic containers (Solmaz and Oybak Dönmez 2013: 290). In the same region, a store of gold-of-pleasure (*Camelina sativa*) seeds is reported from the fortress of Yoncatepe (Table 7.5) (Oybak Dönmez and Belli 2007).

- *Fruits and nuts*

At Iron Age Gordion, Kuşaklı, and Kerkenes viticulture appears to have played a minor role, given either the absence (Kerkenes) or very limited (Gordion and Kuşaklı) attestation of grape seeds (Figure 7.27). On the contrary, evidence from Niğde-Kınık Höyük indicates that viticulture likely represented an activity of central importance in southern Cappadocia, starting from the early 1st millennium BCE (Figure 7.27). As discussed in detail in Section 6.4.4, grape seeds, charcoal, and pedicel are first attested at Niğde-Kınık Höyük during period KH-P VA (1000-800 BCE). Grape remains further increase during period KH-P IV (800-500 BCE), with *Vitis* seeds accounting for the 9% of the total of economic remains (chaff excluded) (Figure 7.27) (Chapter 6).

Although in small quantities, fig seeds are documented at both Gordion and Niğde-Kınık Höyük (Figure 7.27). As already noted, given the sensitivity of this crop to winter frosts (e.g., Karami et al. 2018), fig likely represented in central Anatolian an exotic taxon. Figs could have been possibly traded as dried fruits, which production in Mediterranean sites is documented at Late Bronze Age Kilise Tepe (Section 7.6.1). Worth of note is the sizable number of cornelian cherry (*Cornus mas*) endocarps found at Kerkenes (Figure 7.27). As discussed by Smith and Branting (2014: 48, with further references), fruits of cornelian cherry could be consumed unprocessed or as jams, sweetmeats, and (possibly fermented) drinks. In this chapter, carpological evidence of cornelian cherry has been already encountered at Middle Bronze Age levels of Kültepe-*Kaneš* (Section 7.4.1).

Very limited archaeobotanical evidence of fruits and nuts taxa is documented at eastern Anatolian sites. This paucity is likely resulting from sampling strategies targeting grain storage areas, considering that both textual and archaeological evidence indicates that viticulture represented an important aspect of the Urartian agricultural economy (e.g., Çavuşoğlu et al. 2014: 32-33, with references).

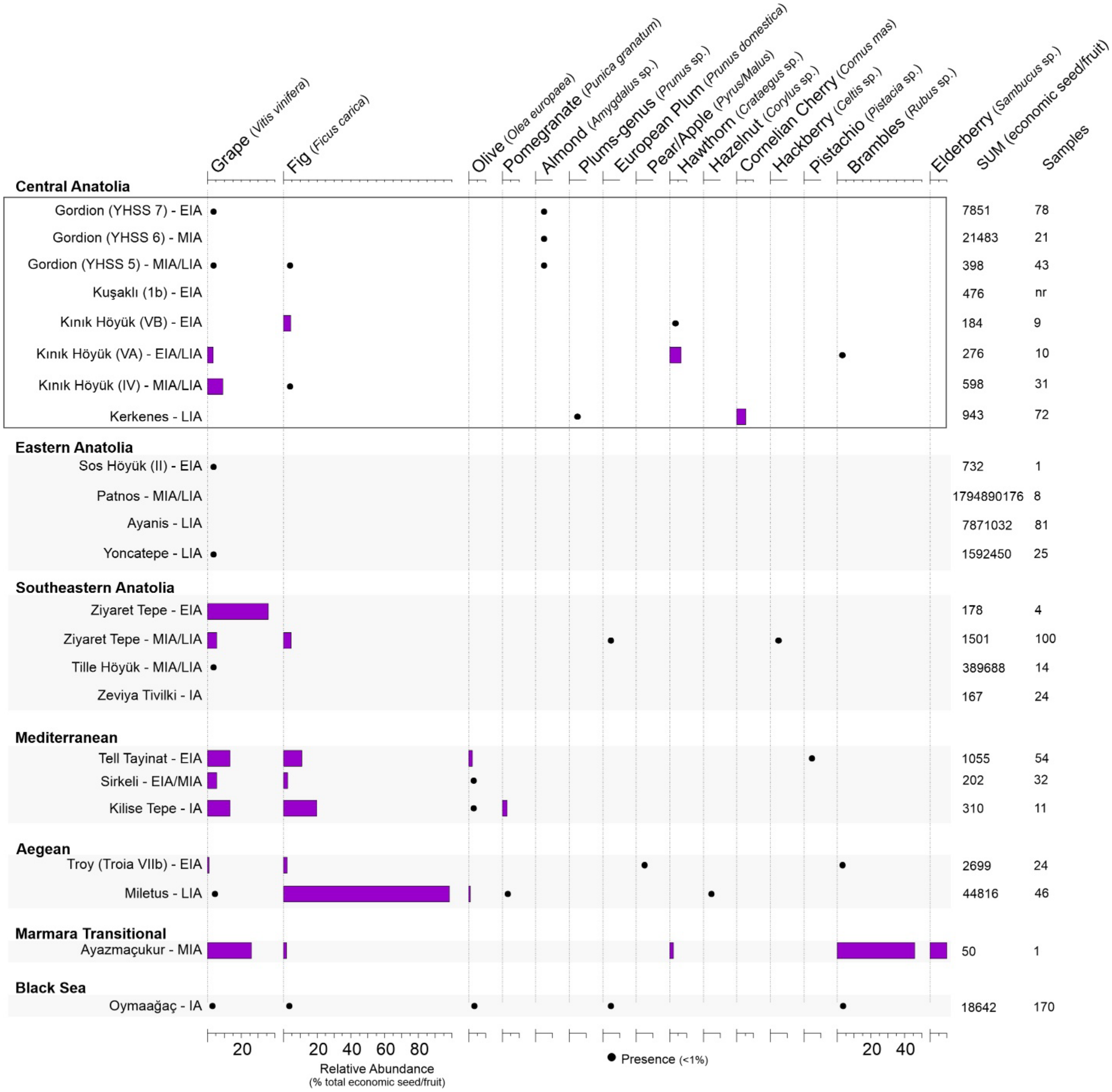


Figure 7.27 – *IA archaeobotanical sequences: fruits and nuts. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum (see* Section 7.1*). Only assemblages with more than 50 selected economic seed/fruit remains are included in the figure.*

Grape, fig, and olive carpological remains are ubiquitously attested in the circum-Mediterranean regions of Anatolia, at times in very sizable quantities – e.g., the mineralized and charred fig remains from archaic Miletus (Figure 7.27). The latter assemblage is further characterized by an abundant attestation of olive endocarps, hidden in relative abundances by the high count of fig remains. A regional increase in olive cultivation could be further inferred by pollen data (e.g., Gölhisar Gölü; Eastwood et al. 1998: 73), although without reaching the values recorded in coeval (and earlier) Levantine records (Langgut et al. 2019).

In southeastern Anatolia viticulture remained a component of the regional farming system, as documented by comparatively abundant grape remains found at Ziyaret Tepe (Early Iron Age and Neo-Assyrian) and Tille Höyük (Neo-Assyrian) (Figure 7.27). The latter overshadowed in relative abundances by the high count of millet remains.

7.6.2 - *Iron Age agriculture: between continuities and discontinuities*

The collapse of the Hittite empire opened to a phase of reconfiguration of the economic, political, and (possibly) ethnic landscape of central Anatolia. As I have already noted in Section 1.2.4, there is large consensus in recognizing the presence of different regional trajectories in the aftermath of the fall of *Ḫattuša* (e.g., Hawkins 1988, 2000: 73-79, Sams 2011: 605-607, 2012a, Frangipane and Liverani 2013, Castellano 2018, d'Alfonso 2020). The highest degree of discontinuity from the previous Late Bronze Age (Hittite) tradition is documented at the former core of the Empire – i.e., northcentral Anatolia, the 'Land of Hatti'. In this region, economy seems to have reverted from a centralized to a household scale, as exemplified by the abandonment of the ceramic wheel technology in favor of handmade productions (Genz 2004: 24). Similar dynamics are documented in west-central Anatolia, most notably at the site of Gordion (Voigt and Henrickson 2000: 42-46). In contrast to the two aforementioned regions, a degree of transmission of the Hittite tradition into the Early Iron Age has been proposed for the southern portion of the central Anatolian Plateau (Mora and d'Alfonso 2012a). Leaving to Section 1.2.4 a more detailed discussion of the archaeological and historical context, in the following paragraphs I will analyze whether or not these overarching processes led to visible changes in agricultural systems.

- *The Early Iron Age crop assemblages*

As discussed in the previous section, the Early iron Age sequences from Gordion and Kuşaklı are characterized by an increase in einkorn (Figure 7.25). In central Anatolia einkorn was an important staple during the Early Bronze Age (Section 7.3.1), for then apparently losing importance during the Middle (Section 7.4.1) and Late (Section 7.5.1) Bronze Age, possibly representing in these latter periods a crop of secondary economic importance.

Although quantitatively less striking than at Kuşaklı, the increase in einkorn grains and chaff at Early Iron Age (YHSS-7) Gordion could be regarded as particularly meaningful, given the singularity of this trend in the well-sampled and long-spanning archaeobotanical sequence from the site. Miller (2010: 43) tentatively connected this uptick in einkorn to the presumed arrival at Gordion of allochthonous groups of Balkan origin. As noted by Miller, in comparison to central Anatolia, the economic importance of einkorn in the Balkan peninsula is well attested until a far later chronological stage (e.g., Kroll 1991, Valamoti et al 2018). The underlying hypothesis of newcomers settling in west-central

Anatolia in the early 12th century BCE has been more prominently formulated based on ceramic comparanda (e.g., Voigt and Henrickson 2000) and chronologically later linguistic evidence (e.g., Sams 2011) (see Section 1.2.4 for further details).

The hypotheses of a migration of southeastern European groups into central Anatolia at the onset of the Early Iron Age has been the subject of an animated debate in the scholarship. Authors such as Genz (2005) and Seeher (2010) have rejected comparanda between central Anatolia EIA handmade ceramic wares and Thracian/Balkan counterparts, favoring conversely a comparisons with earlier local productions dating to the Early and Middle Bronze Age. In order to explain the obvious chronological gap, Genz (2005) speculated that the earlier ceramic tradition could have survived in regions that remained removed from a direct Hittite control (e.g., some areas of western and northern Anatolia) or in more rural and peripheric areas of the Hittite empire. Considering the aforementioned importance of einkorn in Early Bronze Age central Anatolia (Section 7.3.1), the archaeobotanical evidence would fit well also this second model.

Regardless of whether the changes in the archaeobotanical assemblages from Gordion and Kuşaklı are related to newcomers, to the resurfacing of local traditions, or to other factors, I believe that it should be also considered the broader economic context of these finds. In other words, no matter the underlying causes, the return to a household scale in agricultural production could have promoted a degree of changes in the cultivation strategies in place, including shifts in emphasis on the cultivation of some cereals rather than others.

Moving to the southcentral Anatolia, archaeobotanical evidence from Niğde-Kınık Höyük dating to the Early Iron Age (KH-P VB; 1180-1000 BCE) is comparatively limited (Table 7.5), yet it is possible to advance some preliminary considerations. Hulled wheats are to date unattested during the EIA occupation of the site, hinting to a very minor role (if any) that both einkorn and emmer played in the local late 2nd millennium BCE economy. It might appear, thus, that a different farming system was in place in southern Cappadocia. These considerations are surely hypothetical, given the far from satisfactory archaeobotanical sampling of the Anatolian Plateau during this chronological phase.

Because of time and space limits, I will do not discuss here in detail the Early Iron Age in the northern Levantine coast and Cilicia. The late 2nd millennium BCE in this region represents an extremely complex and dynamic period, defined by the presence of allochthonous (chiefly Aegean) cultural and ethnic influences, which are combined to a localized degree of continuity in selected aspects of the Late Bronze Age tradition (e.g., Welton et al. 2019). If we turn our attention to the archaeobotanical records, as already noted, important differences are found between the available Early Iron Age assemblages from this region (Figure 7.25). It would be tempting, thus, to explain these diverging trends in association to the regional mosaicked socio-cultural and economic landscape. Also in this case, the available evidence is too limited to warrant solid consideration.

- *Large-scale storage in post-Hittite polities*

A discussion of the Iron Age agricultural system in relation to the earlier Hittite tradition, was already provided in Chapter 4, as part on a specific case study on the post-Hittite political economy. In extreme synthesis, on the basis of archaeological and epigraphic evidence of large-scale storage, I have argued that the Hittite tradition of centralized storage (Section 7.5.2) was transmitted into the Iron Age in the former southern and southeastern peripheries of the Empire – including southcentral Anatolia. Leaving to the aforementioned chapter (in particular to Section 4.3.2) a more detailed analysis, I will here provide only a brief summary, which is principally aimed at framing this discussion in the broader context of Iron Age farming.

Archaeological evidence from Niğde-Kınık Höyük period KH-P VA (ca. 1000-800 BCE) suggests that the site hosted an institution that was able to extract and manage large quantities of agricultural surpluses. This hypothesis is based on the discovery of two large-scale underground silos, located on the southern slope of the mound, in proximity to the inner façade of the Iron Age citadel walls. A use-phase of these structures is radiocarbon dated to 1002-843 cal. BCE (95.4% probability). The scale of these granaries is by no means compatible with a domestic function, but it rather supports the presence of a form of centralized accumulation of agricultural products (Chapter 4). The evidence from Niğde-Kınık Höyük is not isolated in the Iron Age archaeological record. Similar large-scale storage facilities are known from other main Iron Age sites, such as Arslantepe-*Melid,* Tille Höyük, Kilise Tepe, and possibly Karmemish. At Arslantepe, three large-scale silos are attributed to Phase 3-Level 7, dated to an initial stage of the Early Iron Age II (ca. 1000-900 BCE) (Manuelli 2020). At Tille Höyük, large, structured pits interpreted as storage facilities are documented in Level IV (late 10th - early 9th century BCE) and Level V (9th century BCE) (Blaylock 2009: 87-126). A chronologically later example of Iron Age large-scale storage is found at Kilise Tepe, in the Göksu Valley (Level 2-Surface 1, ca. 800 to 650 BCE) (Heffron et al. 2017: 134-142). As discussed in Section 4.3.2 and 2.3.3, in addition to the archaeological record, granaries are comparatively frequently attested in the coeval Anatolian hieroglyphic epigraphic record.[38] Centralized storage appears, thus, as a crucial feature of Early-Middle Iron Age northern Syria and southcentral Anatolia, both in the economies of those polities and in the rhetoric of the self-celebrative program carried out by their rulers. In Chapter 4, I have argued for a possible Late Bronze Age origin of this tradition of large-scale storage, proposing that it could have stemmed, either directly or indirectly, from an earlier Hittite economic tradition.

The geographic distribution of the archaeological and epigraphic attestations of Iron Age large-scale storage appears limited to the former southern and eastern peripheries of the Empire, regions in which continuity between the Late Bronze and Iron Age has already been demonstrated in other respects. In contrast to these latter regions, a different picture emerges from north-central and west-central Anatolia, where to date large-scale storage facilities are unattested during the Iron Age (Section 4.3.2). Also in these regards, thus, it is possible to reconstruct the presence of distinct regional dynamics within the Anatolia plateau, involving a different degree of involvement of the central institutions in agricultural production and management, a topic that I have extensively discussed in Chapter 4.

- *Some considerations on irrigation in the Iron Age*

A final note should be made in regard to the topic of irrigation in the Anatolian Peninsula during the Iron Age. With the possible exception of the surroundings of Gordion (Marsh 1999), to my knowledge there is currently a lack of direct archaeological evidence of irrigation from this period in central Anatolia. This absence of evidence is likely imputable to the poor archaeological visibility of these features and the paucity of extensive geoarchaeological fieldwork specifically targeting the identification and dating of water-management structures.

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[38] KARKAMIŠ A30h (CHLI II.42), AHMAR 5 (CHLI III.3), MARAŞ 8 (CHLI IV.1), ISKENDERUN (CHLI IV.3), HAMA 8 (CHLI IX.6), KARATEPE 1 (CHLI I.1)

Although conjectural at best, indirect evidence of a possible expansion of irrigation in Iron Age Anatolia could be seen in the increased attestation of millet in archaeobotanical assemblages. As discussed elsewhere (e.g., Section 7.2.1), the cultivation of this summer crop likely necessitates in regions under a semi-arid/arid Mediterranean climatic regime (wet winters and dry summers) of a degree of artificial watering. Large concentrations of millet grains are attested at Middle Iron Age sites in eastern (Ayanis) and southeastern Anatolia (Tille Höyük) (Section 7.6.1). In the latter region, the presence of irrigation could be tentatively inferred also by the attestation of comparatively abundant poly-rowed barley chaff remains at Ziyaret Tepe (Section 7.6.1). In this period, eastern and southeastern Anatolia were under the respective control of two polities which are traditionally associated with large-scale water management projects: Urartu (see Çifci and Greaves 2013, with further references) and the Neo-Assyrian Empire (see Kühne 2018, with further references). An expansion of irrigation in these regions is accordingly somehow expected. Because of time and space constrains, I leave this interesting topic to future research.

7.7 Agriculture during the Achaemenid and Hellenistic periods (ca. 550-1 BCE)

The second half of the 1st millennium BCE corresponds in Anatolian history to the Achaemenid (ca. 550-330 BCE) and Hellenistic (ca. 330-1 BCE) periods. In the historical introduction provided in Section 1.2.5, it has been noted how this period in central Anatolia corresponds to a combination of external influences (e.g., Persian, Greek, and Celtic) which coexisted with an enduring local Anatolian tradition. Which agricultural landscapes are associated with these processes?

7.7.1 *The Achaemenid and Hellenistic archaeobotanical record: an overview*

Archaeobotanical evidence dating to the Achaemenid and Hellenistic periods is summarized in Table 7.6. The cereal record is graphically presented in Figure 7.28, pulses, oilseeds, and miscellaneous economic plant in Figure 7.29, and fruits-nuts in Figure 7.30. The methodology used is outlined in Section 7.1.

In central Anatolia, Gordion and Niğde-Kınık Höyük are the two reference archaeobotanical sequences covering the second half of the 1st millennium BCE. At the site of Gordion, the Late Phrygian phase (YHSS 4) corresponds to the Achaemenid period, while the Hellenistic period is represented by phase YHSS 3. From an archaeobotanical perspective, both periods have been very intensively studied, with respectively 108 and 118 published carpological samples (Miller 2010, Marston 2017). The evidence from Gordion is well-complemented by the coeval sequence from Niğde-Kınık Höyük (Chapter 5 and 6). The second half of the 1st millennium BCE is divided at Niğde-Kınık Höyük into two Occupation Periods: KH-P III (Achaemenid/Early Hellenistic; ca. 500 to 200 BCE), and KH-P IIB (Late Hellenistic; ca. 200 to 1 BCE) (Section 3.4.3). In addition to Gordion and Kınık Höyük, quantitatively published archaeobotanical evidence dating to the second half of the millennium is limited to the site of Pessinonte (van Peteghem 2005, 2008, van Peteghem and Braeckman 2001), which is however of difficult use due to poor sampling coverage and low specimen counts (Table 7.6). As I will discuss later in this paragraph, similar considerations apply to the other Anatolian regions. It is, furthermore, to be note that important archaeobotanical evidence from some key sites (e.g., Sagalassos and Duzen Tepe) is to date not yet published in final (quantitative) form (e.g., Fuller et al. 2012, De Cupere et al 2017).

	Period	Samples	NISP	**Cereals** Barley (*Hordeum vulgare*)	Naked Barley (*Hordeum vulgare* var. *nudum*)	Emmer (*Triticum dicoccum*)	Einkorn (*Triticum monococcum*)	Spelt (*Triticum spelta*)	Free-Threshing Wheat (*Triticum aestivum/durum*)	Rye (*Secale cereale*)	Broomcorn Millet (Panicum miliaceaum)	Foxtail Millet (*Setaria italica*)	Millets (Panicum/*Setaria*)	**Pulses** Lentil (*Lens culinaris*)	Bitter Vetch (*Vicia ervilia*)	Fava Bean (*Vicia faba*)	Common Vetch (*Vicia sativa*)	Chickpea (*Cicer arietinum*)	Pea (*Pisum sativum*)	Field Peas (*Lathyrus* sp.)
Central Anatolia																				
Gordion (YHSS 4)	Ach.	108	4822	58%		<1%	<1%		38%	<1%	<1%	4%		10%	90%					
Gordion (YHSS 3A/B)	Hell.	118	2674.5	51%		<1%	<1%		44%	<1%	<1%	4%		43%	55%			2%		
Pessinonte	Hell.	2	8.5	+		*								*						
Kınık Höyük (KH-P III)	Ach./Hell.	56	1675	38%		1%			60%	1%	<1%	<1%	<1%	8%	90%	1%			1%	
Kınık Höyük (KH-P IIB)	Hell.	39	1131	25%	<1%	<1%			68%	5%	<1%	<1%	1%	++	+++	+			++	
Eastern Anatolia																				
Aşvan-Aşvan Kale	Hell.	22	220526	5%					4%		90%	<1%		45%	43%			10%	3%	
Southeastern Anatolia																				
Karkemish	Hell.	1	5	*																
Tille Höyük	Hell.	4	31310												<1%			5%	24%	71%
Mediterranean																				
Tatarlı Höyük	Hell.	38	4033	27%		49%	8%	1%	13%		2%			++	+				*	
Aegean																				
Ephesos	Hell.	1	41	*																
Troy (Troia VIII)	Ach.	2	14	++													+			
Troy (Troia VIII)	Hell.	3	54	+++													+			
Marmara Transitional																				
Ayazmaçukur	Hell.	1	83																	
Daskeleion (Vb)	Ach.	1	63	+					++								+++			
Daskeleion (IV)	Hell.	2	1															*		
Black Sea																				
Oymaağaç	Hell./Rom.	5	11	+					+										*	*

	Period	Fruits and Nuts																		
		Grape (*Vitis vinifera*)	Fig (*Ficus carica*)	Olive (*Olea europaea*)	Russian Olive (*Elaeagnus angustifolia*)	Walnut (*Juglans regia*)	Hezelnut (*Corylus* sp.)	Almonds (*Amygdalus* sp.)	Plums-genus (*Prunus* sp.)	Cherries (*Prunus cerasus/avium*)	Pear/Apple (*Pyrus/Malus*)	Hawthorn (*Crataegus* sp.)	Mulberry (*Morus* sp.)	Jerusalem thorn (*Paliurus spina-christi*)	Pistachio (*Pistacia* sp.)	Pine (*Pinus* sp.)	Oak (*Quercus* sp.)	Brambles (*Rubus* sp.)	Elderberry (*Sambucus* sp.)	Caper (*Capparis* sp.)
Central Anatolia																				
Gordion (YHSS 4)	Ach.	+	+					*		*										
Gordion (YHSS 3A/B)	Hell.	++																		
Pessinonte	Hell.												*							
Kınık Höyük (KH-P III)	Ach./Hell.	95%	<1%		2%	2%						1%								
Kınık Höyük (KH-P IIB)	Hell.	88%	1%		1%	1%			<1%		<1%	8%						<1%		
Eastern Anatolia																				
Aşvan-Aşvan Kale	Hell.	38%						6%	1%						6%		49%			
Southeastern Anatolia																				
Karkemish	Hell.	+																		
Tille Höyük	Hell.																			
Mediterranean																				
Tatarlı Höyük	Hell.	<1%	<1%	<1%											<1%	1%				98%
Aegean																				
Ephesos	Hell.		+++																	
Troy (Troia VIII)	Ach.	*	*																	
Troy (Troia VIII)	Hell.	+		+										*						
Marmara Transitional																				
Ayazmaçukur	Hell.	+	+	+		*	*										+	++++	*	
Daskeleion (Vb)	Ach.																			
Daskeleion (IV)	Hell.																			
Black Sea																				
Oymaağaç	Hell./Rom.																			

	Period	Flax (*Linum usitatissimum*)	Cotton (*Gossypium* sp.)	Fennel Flower (*Nigella sativa*)	Gold-of-Pleasure (*Camelina sativa*)	Safflower (*Carthamus tinctorious*)	Coriander (*Coriandrum sativum*)
Central Anatolia							
Gordion (YHSS 4)	Ach.					+	*
Gordion (YHSS 3A/B)	Hell.				+	+	
Pessinonte	Hell.						
Kınık Höyük (KH-P III)	Ach./Hell.						
Kınık Höyük (KH-P IIB)	Hell.						
Eastern Anatolia							
Aşvan-Aşvan Kale	Hell.	48%	<1%	52%			
Southeastern Anatolia							
Karkemish	Hell.						
Tille Höyük	Hell.						
Mediterranean							
Tatarlı Höyük	Hell.	+		+			
Aegean							
Ephesos	Hell.						
Troy (Troia VIII)	Ach.						
Troy (Troia VIII)	Hell.						
Marmara Transitional							
Ayazmaçukur	Hell.						
Daskeleion (Vb)	Ach.						
Daskeleion (IV)	Hell.						
Black Sea							
Oymaağaç	Hell./Rom.						

Table 7.6 – *Achaemenid and Hellenistic archaeobotanical sequences, for references see Section 2.1.3 and Appendix 1. If the sum of the specimens in a given group (cereals, pulses, etc.) exceed the cutoff value of 100, data are provided as relative abundances calculated using the group total as sum. On the contrary, abundances are reported using a semi-quantitative scale (*= 1, += 2 to 9, ++= 10 to 24, +++= 25 to 49, ++++= >49).*

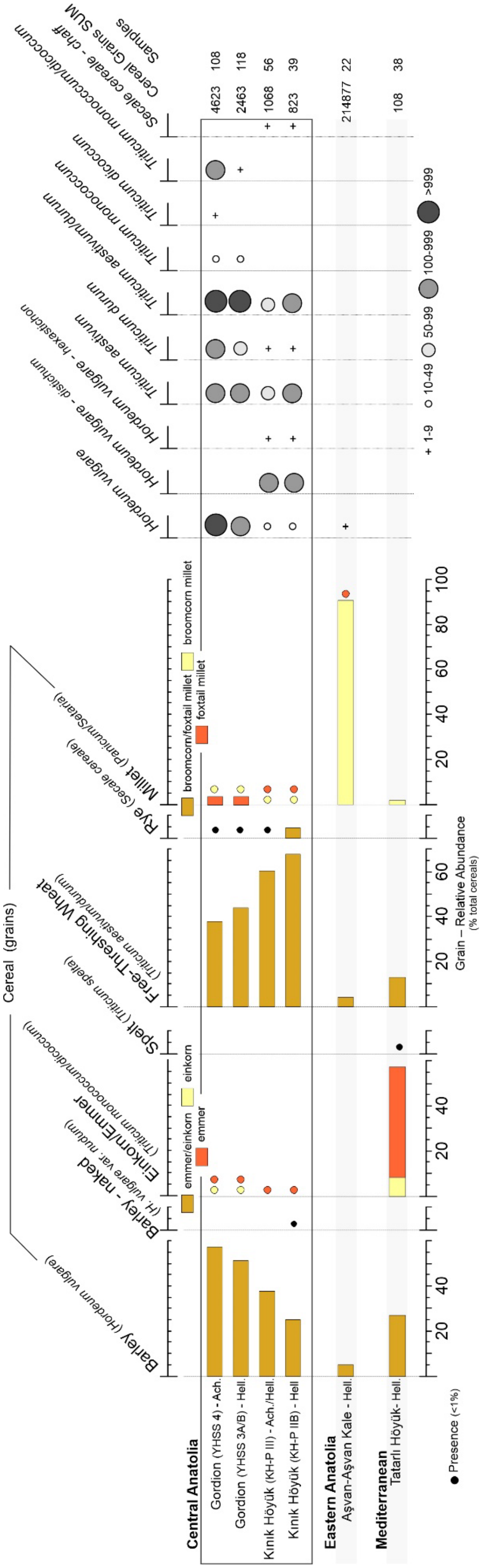
- *Cereal assemblages*

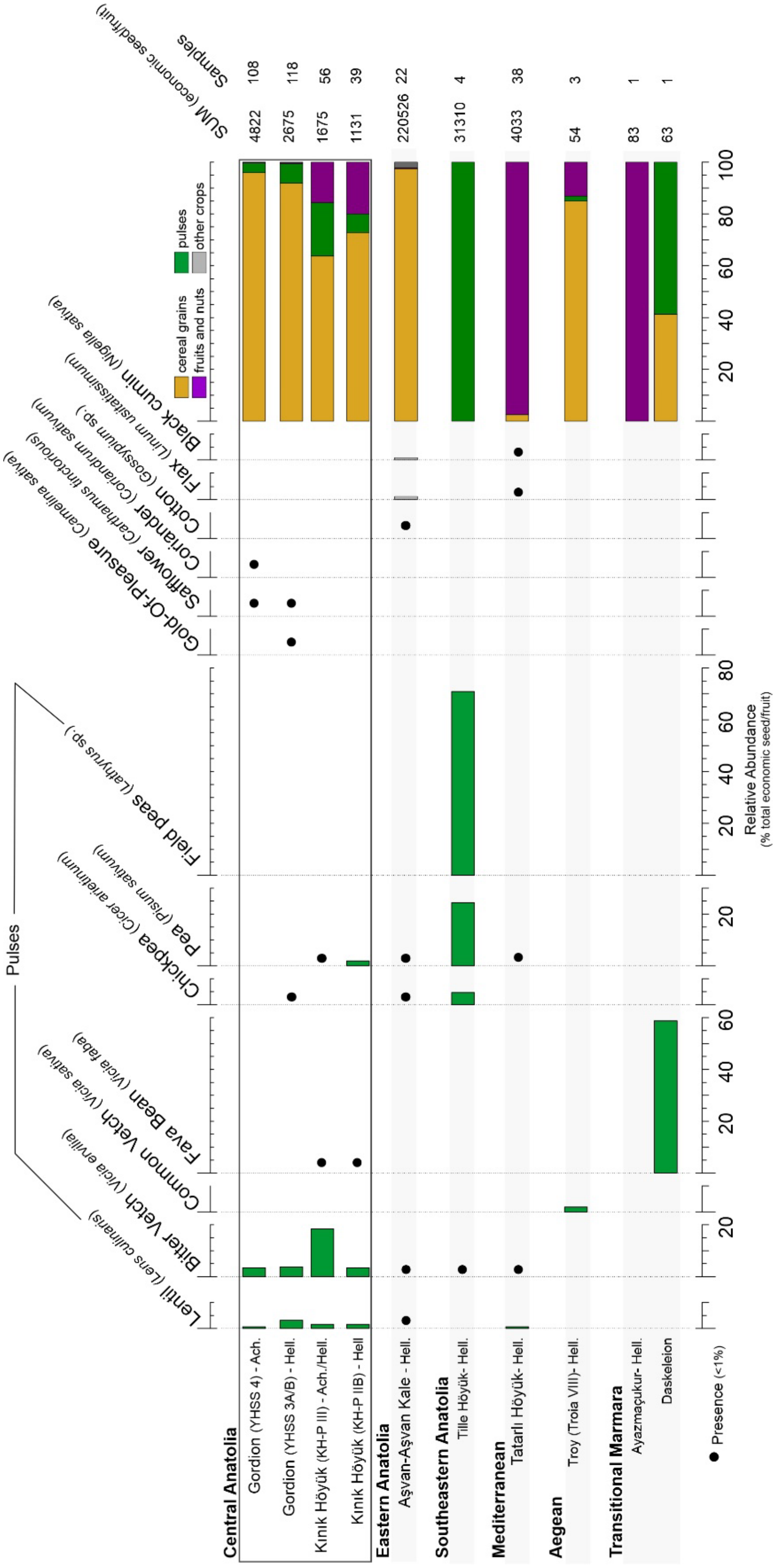
In continuity with the previous trend, both at Gordion and Niğde-Kınık Höyük cereal farming is based on the cultivation of free-threshing wheat and hulled barley (Figure 7.28). At Kınık Höyük, chaff fragments support the marked predominance of respectively bread wheat (*Triticum aestivum* s.l.) and 2-row hulled barley (*Hordeum vulgare* var. *distichon*), with only a singular occurence of rachis attributable respectively to macaroni wheat (T. *durum* s.l.) and poly-row hulled barley (*H. vulgare* var. *hexastichum*) (Figure 7.28). At Gordion the latter two taxa appear to have had a somehow less marginal, although still secondary, role (Figure 7.28) (Miller 2010: 44, Marston 2017: 111, 113).

As noted in the previous section, in comparison to Gordion, Kınık Höyük is characterized by a higher wheat-to-barley ratio. This trend further expands in the period here considered (Figure 7.28). In full continuity with the previous phase, hulled wheats play a very minor role at both sites (Figure 7.28). The single specimens attributed to einkorn or emmer could easily represent either background noise from earlier Bronze Age strata or grains from single plants growing in free-threshing wheat fields. Broomcorn and foxtail millet are attested both at Gordion and at Kınık Höyük, although in more significant quantities at the former site (Figure 7.28). Finally, it should be noted the presence at Kınık Höyük during period KH-P IIB (ca. 200-1 BCE) of a discrete number of rye grains and chaff fragments (Figure 7.28), which suggests that this crop was farmed in the region by the end of the millennium.

Outside central Anatolia, the only published sequences containing more than 50 cereal grains are Tatarlı Höyük and Aşvan Kale (Section 2.1.3). At the latter site, the Hellenistic assemblage is dominated by a large concentration of broomcorn millet (Figure 7.28), which testify the cultivation of this cereal in the Euphrates Valley, in continuity with Iron Age evidence from Tille Höyük (Section 7.6.1). The cereal assemblage from Aşvan Kale further includes free-threshing wheat and hulled barley (Figure 7.28). In line with central Anatolian sites, hulled wheats are not attested. On the contrary the latter are found in comparatively abundant quantities at Hellenistic Tatarlı Höyük, in Cilicia (Figure 7.28). This evidence remains of difficult interpretation given its singularity in the late 1st Millennium BCE.

(Next page) Figure 7.28 – *Achaemenid and Hellenistic archaeobotanical sequences: cereals. The graph is based on relative abundance calculated using the total of selected cereal grains as sum. Chaff is reported using a semi-quantitative scale. For further details see Section 7.1. Only assemblages with more than 50 cereal grains are included.*


Central Anatolia
Gordion (YHSS 4) - Ach.
Gordion (YHSS 3A/B) - Hell.
Kınık Höyük (KH-P III) - Ach./Hell.
Kınık Höyük (KH-P IIB) - Hell
Eastern Anatolia
Aşvan-Aşvan Kale - Hell.
Mediterranean
Tatarlı Höyük- Hell.
● Presence (<1%)
Cereal (grains)
Barley (Hordeum vulgare)
Barley - naked (H. vulgare var. nudum)
Einkorn/Emmer (Triticum monococcum/dicoccum)
emmer/einkorn
emmer
einkorn
Spelt (Triticum spelta)
Free-Threshing Wheat (Triticum aestivum/durum)
Rye (Secale cereale)
Millet (Panicum/Setaria)
broomcorn/foxtail millet
foxtail millet
broomcorn millet
20
40
60
80
100
Grain – Relative Abundance (% total cereals)
Hordeum vulgare
Hordeum
Hordeum vulgare - distichum
Hordeum vulgare - hexastichon
Triticum aestivum
Triticum durum
Triticum aestivum/durum
Triticum monococcum
Triticum dicoccum
Triticum monococcum/dicoccum
Secale cereale - chaff
Cereal Grains SUM
Samples
4623 108
2463 118
1068 56
823 39
214877 22
108 38
+ 1-9
○ 10-49
50-99
100-999
>999


Pulses
Lentil (Lens culinaris)
Bitter Vetch (Vicia ervilia)
Common Vetch (Vicia sativa)
Fava Bean (Vicia faba)
Chickpea (Cicer arietinum)
Pea (Pisum sativum)
Field peas (Lathyrus sp.)
Gold-Of-Pleasure (Camelina sativa)
Safflower (Carthamus tinctorius)
Coriander (Coriandrum sativum)
Cotton (Gossypium sp.)
Flax (Linum usitatissimum)
Black cumin (Nigella sativa)
cereal grains
fruits and nuts
pulses
other crops
SUM (economic seed/fruit)
Samples
Central Anatolia
Gordion (YHSS 4) - Ach.
4822
108
Gordion (YHSS 3A/B) - Hell.
2675
118
Kınık Höyük (KH-P III) - Ach./Hell.
1675
56
Kınık Höyük (KH-P IIB) - Hell
1131
39
Eastern Anatolia
Aşvan-Aşvan Kale - Hell.
220526
22
Southeastern Anatolia
Tille Höyük- Hell.
31310
4
Mediterranean
Tatarlı Höyük- Hell.
4033
38
Aegean
Troy (Troia VIII)- Hell.
54
3
Transitional Marmara
Ayazmaçukur- Hell.
83
1
Daskeleion
63
1
● Presence (<1%)
20
20
40
60
20
20
40
60
80
Relative Abundance
(% total economic seed/fruit)
20
40
60
80
100

(Previous page) Figure 7.29 – *Achaemenid and Hellenistic archaeobotanical sequences: pulses and oilseeds. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum* (*see Section 7.1*). *Only assemblages with more than 50 selected economic seed/fruit remains are included.*

- Pulses, oilseeds, herbs, and miscellaneous taxa

In continuity with the pattern already discussed for the previous periods, lentil and bitter vetch are the predominant pulses in archaeobotanical records from central Anatolia (Figure 7.29). The increase in bitter vetch at Kınık Höyük during KH-P III (500-200 BCE) is driven by two samples particularly rich in this taxon (Chapter 6). It is, furthermore, to be noted a degree of increase in attestation of pea at Kınık Höyük during the Hellenistic period (Figure 7.29), which could suggest the local increased importance of this crop by the end of the 1st millennium BCE.

Outside central Anatolia, of particular interest is the pulse assemblage from Tille Höyük, in the Euphrates Valley Figure 7.29. One Hellenistic sample, originating from a storage vessel, is in fact characterized by the presence of a mixture of field pea (*Lathyrus sativus/cicera*) and common pea (*Pisum sativum*), with the former quantitatively predominant. Nesbitt (2016: 379) suggested this record could have originated from a mixed cultivation of these two pulses. The three other samples are all concentrations of chickpea, which cultivation appears consequently to have been particularly favored. Finally, at Daskeleyon, in the Marmara region, it is recorded the attestation of fava bean (Figure 7.29). Due to the low specimen counts and unsatisfactory sampling coverage, this evidence remain, however, of limited use.

Regarding oilseeds, it should be noted the occurrence at Aşvan-Kale of two distinct concentrations of respectively black cumin and flax, both of which originated from a destruction level (Figure 7.29). At Aşvan-Kale it is recorded also the presence of a single seed of cotton (Figure 7.29), given the abundant attestation of this taxon in Medieval levels from the same site, the intrusive nature of this singular carpological find cannot be excluded.

- *Fruits and nuts*

Fruits and nuts assemblages are presented in Figure 7.30. As I will further discuss in Section 7.7.2, also in these regards, important differences are found between Gordion and Niğde-Kınık Höyük, with the latter site is characterized by a more abundant and floristically richer assemblage (Figure 7.30). Grape is by far the most abundant taxon found in the fruits and nuts record from Kınık Höyük, accounting during the Late Hellenistic period (KH-P IIB) for about the 18% of the total of the economic seed/fruit remains identified at the site. As discussed in Section 6.4.4, the evidence of grape seeds at Kınık Höyük is well-complemented by equally abundant attestation of grapevine wood charcoal and grape pedicels. In Addition to grape, the carpological assemblage from Kınık Höyük stands out for the presence of a diverse assemblage of fruit and nut taxa – including walnut, Russian olive, fig, and various Rosaceae (*Pyrus*/*Malus*, *Crateagus* sp., and *Prunus* sp.).

Outside central Anatolia, the record from Tatarli Hoyuk stands out for the presence of a single concentration of caper seeds (*Capparis* sp.) (Aslan et al 2014) (Figure 7.30). A comparatively rich fruit-nuts assemblage is attested at Ayazmaçukur (Figure 7.30); the contextual origin of these materials remains, however, unclear (Willcox 2003).

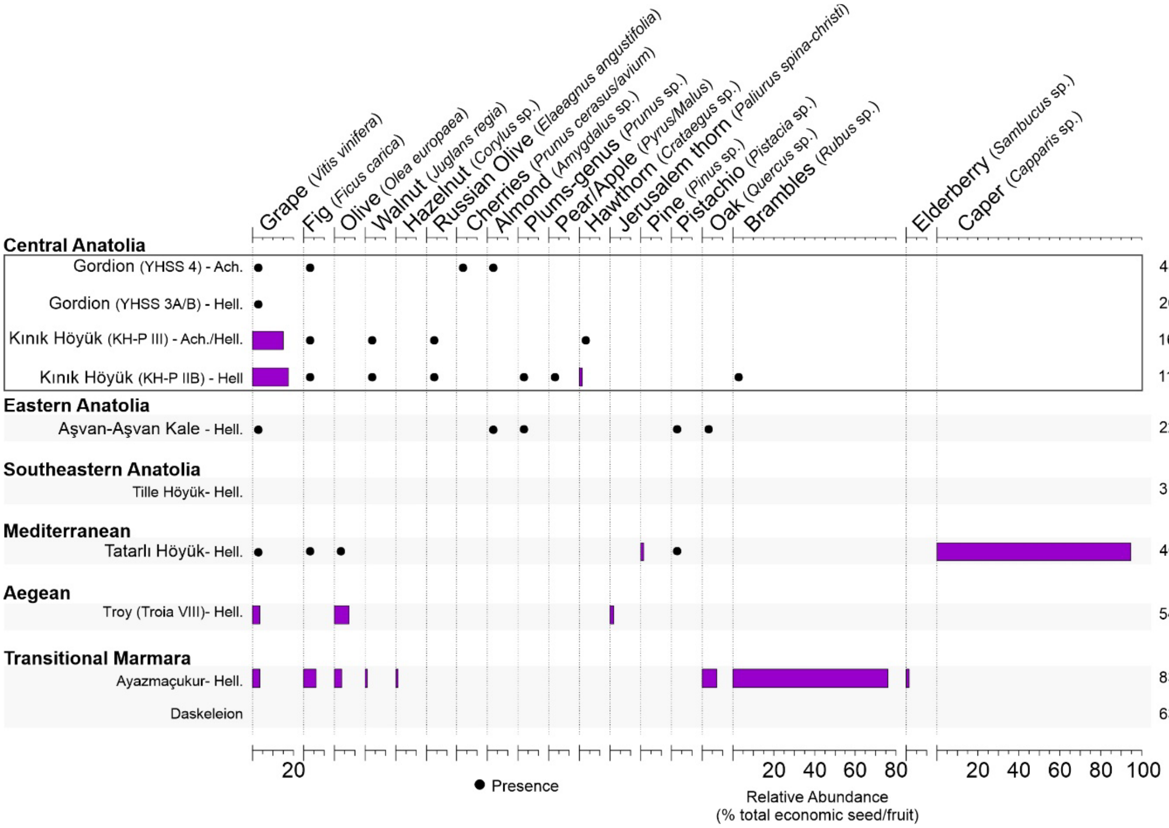


Figure 7.30 – *Achaemenid and Hellenistic archaeobotanical sequences: fruits and nuts. The graph is based on relative abundance calculated using the total of selected economic seed/fruit remains as sum* (*see Section 7.1*). *Only assemblages with more than 50 selected economic seed/fruit remains are included in the figure.*

7.7.2 Agriculture at *Gordion and Niğde-Kınık Höyük in the Achaemenid and Hellenistic periods*

The second half of the 1st millennium BCE is to date a period poorly known in central Anatolia (Section 1.2.5). Archaeobotanical research is no exception to this general trend, as well-evidenced in the literature survey I have provided in the previous paragraphs. This is a necessary premise in order to emphasize the difficulties in reconstructing an agricultural history of central Anatolia, and more in general Asia Minor, during the Achaemenid and Hellenistic periods.

Given these problematic aspects, to which more pragmatically it is added the incumbent necessity to bring this dissertation to a conclusion within the due time, this section will be limited to a concise comparison of the Achaemenid and Hellenistic carpological assemblages from Gordion and Niğde-Kınık Höyük. I will leave to future research a proper discussion of other aspects of agriculture in the second half of the 1st millennium BCE, as well as a more articulated and nuanced comparison of the two sites – which would necessitate to include also zooarchaeological and geoarchaeological evidence.

As I have already remarked elsewhere, Gordion provides one of the most intensively studied and best published archaeobotanical sequence from Asia Minor (Miller 2010, Marston and Miller 2014, Marston 2017). The evidence from Gordion allows to obtain a long-term diachronic view on local and regional farming, spanning from the Late Bronze Age to the Medieval period. During both the Achaemenid (YHSS-4) and Hellenistic (YHSS-3) periods, hulled barley and free-threshing wheat were the two main cereals attested at the site. The ratio between these two crops is remarkably stable through time, with consistently a marked preponderance of barley (Figure 7.32). An increase in the contribution of wheat is recorded only during the Roman period (Marston and Miller 2014, Marston 2017: 109), which has been accordingly interpreted (Marston 2017: 121-122, Çakırlar and Marston 2019) as a possible indication of a switch to a more risk-oriented form of cereal farming.

The sequence from Gordion, in the second half of the 1st millennium BCE as well as earlier, is further characterized by the paucity in fruit crops, including a small number (18, considering data from Miller 2010 and Marston 2017) of grape seeds (Figure 7.31). Considering the intensity of sampling and the number of specimens analyzed, this trend is to be regarded as a genuine indication of a very minor role played by both viticulture and arboriculture in the agricultural landscape associated to the site.

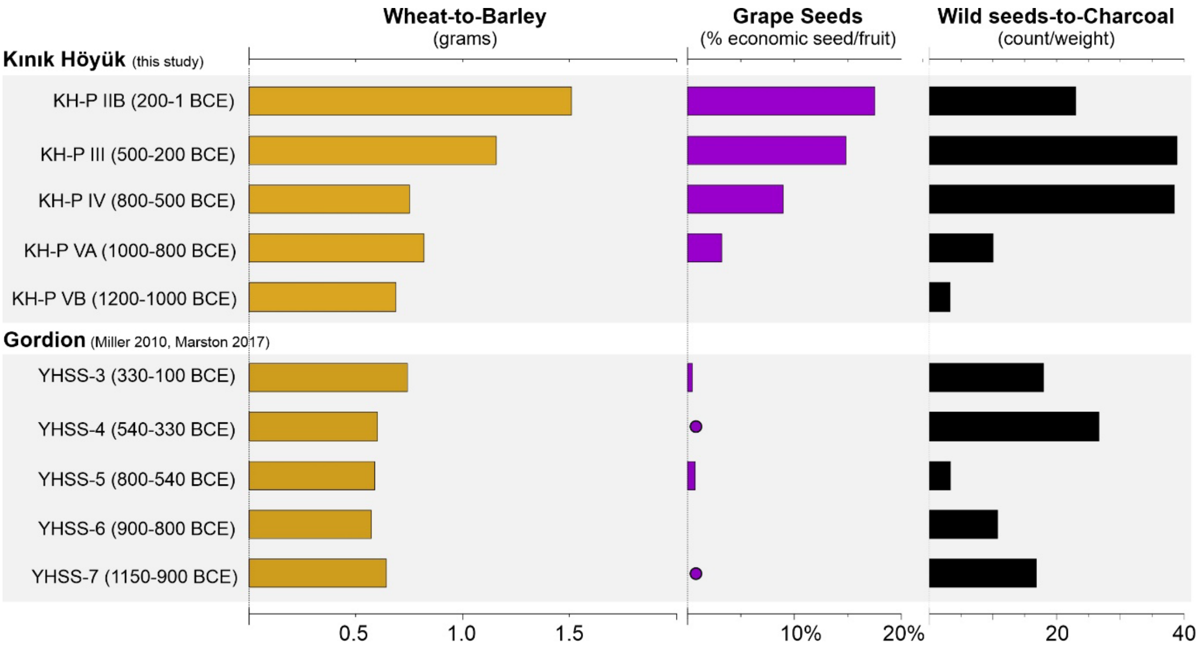


Figure 7.31 – *Comparison of selected carpological indices from the late 2nd and 1st millennia BCE sequences of Niğde-Kınık Höyük (this study) and Gordion (Miller 2010, Marston 2017). The wheat-to-barley ration is calculated using grain weight; the relative abundance of grape seeds is calculated using the total of economic seed/fruit remains as sum; in the wild seed-to-charcoal ratio, unknown specimens are not considered.*

It has been proposed (e.g., Dusinberre 2019) that sheep/goat herding could have represented an activity of greater importance involving Gordion and in its rural hinterland. Dusinberre (2019: 120-121) more explicitly speculated, based on archaeobotanical (Miller 2010, Marston 2017) and zooarchaeological (Zeder and Arter 1994) data, that the economy of Achaemenid Gordion could have been focused on textile production, possibly with a degree of direct involvement of the Persian central power. As noted by the author, based on the Apadana reliefs at Persepolis it could be tentatively hypothesized that the Persians associated some regions of central Anatolia to textile production. In the latter relief, the IX delegation, which is commonly identified in the scholarship as representing the Cappadocians (see Section 1.2.5 for the geographic meaning of the term), is represented bringing a tribute that included textiles (Roaf 1983: 53-54).

In comparison to Gordion, the agricultural system documented at Niğde-Kınık Höyük during the second half of the 1st millennium BCE emerges as clearly distinct (Figure 7.31). More specifically, agriculture at Kınık Höyük is based on the cultivation of bread wheat, 2-row hulled barley, grape, and other fruit crops – including Russian olive, and walnut (Chapter 6). Wheat is more abundantly found than barley, in clear contrast to Gordion (Figure 7.31). The evidence of viticulture from Niğde-Kınık Höyük is in several regards currently unique in the central Anatolian archaeobotanical dataset, considering the abundant and ubiquitous attestation of grape seeds and pedicels (Chapter 6), and grapevine charcoal (Chapter 5). In Section 6.4.4, I have accordingly hypothesized that the site represented a center of supralocal importance for viticulture, possibly with a more specific emphasis in wine production. The cultivation of bread wheat could have represented a second specialization within this agricultural landscape.

As shown in Figure 7.31 – and discussed at length in Chapter 5 and 6 – the aforementioned agricultural landscape orbiting around Kınık Höyük could have represented the culmination of a longer processes, in many regards in continuum rather than in rupture with the previous periods. The latter hypothesis is most notably evidenced by the somehow gradual increase in both grapevine wood charcoal and grape seeds, especially if concentration values (items/liters of sediment processed) rather than relative abundances are considered (Section 6.4.4). This hypothesis is further corroborated by iconographic and textual documentation from southern Cappadocia region, in particular in reference to the centrality during the Iron Age of the cult of the Storm God of the Vineyard (see for examples Section 6.4.4)

How to explain the emergence of the agricultural landscape of Kınık Höyük? Which actors participated in its making? In Section 2.3.4, I have discussed how in his description of Cappadocia, Strabo emphasized the presence in the region of large sanctuaries, which controlled extensive agricultural land and labor – e.g., the sanctuary of Ma at Comana, which according to Strabo (Geography: XII.2.3) had more than six thousand temple-servants and controlled a large agricultural estate; or the sanctuary of Zeus at Venasa, which had almost three thousand temple-servants and "*a sacred territory that is very productive*" (Geography: XII.2.6). The presence of a sanctuary at the site of Kınık Höyük during period KH-P III (Achaemenid/Early Hellenistic) and KH-P IIB (Late Hellenistic) is well-supported by archaeological evidence (Section 6.4.3) (Trameri and d'Alfonso 2020). It would be tempting, thus, to speculatively connect the flourishing in the second half of the 1st millennium BCE of the agricultural landscape of Kınık Höyük to the presence at the site of a cultic center, to some degree resembling the institutions described by Strabo. The question on the possible economic of political role of these sacred centers in central Anatolia during the Hellenistic and Roman period is central in the scholarship, with a comparatively large literature on the topic (e.g., Dupont-Summer 1964, Boffo 1985, Dignas 2002). A discussion of the possible status of cultic-city of Achaemenid and Hellenistic Kınık Höyük has been most recently provided by Trameri and d'Alfonso (2020: 78-80).

Local environmental conditions are a second aspect that very likely favored the emergence of this rich agricultural landscape centered on Kınık Höyük. Although the regions of Gordion and Kınık Höyük receive similar amounts of precipitation (respectively 377 and 366 mm/year according to the WorlClim2; Fick and Hijmans 2017), southern Cappadocia is significantly richer in water. As I have discussed in Chapter 3, the local orography and the endorheic hydrographic setting promote the presence of a higher water table and of comparatively numerous springs and streams. Evidence of irrigation to date is limited to a possible canal, intercepted in proximity to the site and dated to the mid-1st millennium BCE (Castellano et al., *forthcoming*). To the same period, interestingly, dates a possible expansion of irrigation in the nearby Konya Plain, reconstructed by Massa et al. (2020: 57) on the basis of an expansion of small farming settlements in an arid sector of the plain which were previously unsettled.

To conclude this comparison, given the intensity of archaeobotanical research conducted at Gordion and Niğde-Kınık Höyük, the important differences in the archaeobotanical assemblages recorded at the two sites are to be regarded as genuine indication of the presence of distinct agricultural systems. This consideration would suggest the presence in central Anatolia of different regional economic specializations, an aspect that I already had the opportunity to emphasize in the discussion of Strabo provided in Section 2.3.4. More archaeobotanical research is necessary in order to further expose this complexity.

CONCLUSIONS

Farming the Land of Hatti

In this dissertation, in discussing the topic of Anatolian Agricultural history, I have adopted a dual-scalar approach. In Part III (Chapter 7), I have provided a panoramic view on the broader central Anatolian region, partially forgoing resolution in order to access the overarching regional and supraregional trends. Conversely, in Part II (Chapters 3 to 6), I have 'zoomed-in' on a specific region of the central Anatolian plateau: southern Cappadocia. In this latter instance, I have provided a more detailed discussion, deploying a finer resolution throughout my analysis and considerations – down to the specific depositional contexts and associated human behaviors underlying their formation.

The macro-regional scale: the central Anatolian trajectory

As already remarked in the introductory paragraph to Chapter 7, the considerations I have provided at the macro-regional level are to be regarded as provisional, given a far from satisfactory archaeobotanical and archaeological sampling of the Anatolian Plateau. It is, nevertheless, considered useful to advance some tentative general considerations, which are ultimately aimed at driving further research.

In several instances (e.g., Section 1.1), I have emphasized the specificities in central Anatolian climate and environment, which are ultimately directly impacting local and regional agriculture (e.g., Section 7.5.2). Echoing other scholars (e.g., Schachner 2022), I have argued that rather than productivity per se, the main challenged faced by Anatolian farmers is the one of stability and reliability in production. As noted elsewhere (e.g., Section 2.3.2), in fully rain-fed systems, a delay or reduction in the expected autumnal and spring storms could have direct repercussions on agricultural yields. Early Modern historical records (e.g., Quataert 1968, Ertem 2012, 2017, Ayalon 2015) and contemporary data (e.g., Sönmez et al. 2005) indicate that these agricultural droughts are of cyclical occurrence in the Anatolian context. It is, thus, very reasonable to postulate that a similar set of issues was confronted by ancient Anatolian populations and institutions. One of the main aims of the dissertation has been, accordingly, to investigate in which way different polities and institutions throughout Anatolian history approached these challenges.

During the Early Bronze Age (ca. 3000-2000 BCE) (Section 1.2.1), agricultural production appears to have had a secondary role in the political economy of the newly established local powers (Section 7.3.2). Available data suggests that both production and management of staple products were conducted at the household level, lacking any clear evidence supporting the existence of a centralized and redistributive system. Conversely, metal production and trade seem have had a greater centrality in the economic basis of the newborn Anatolian elites. In contrast to the circum-Mediterranean regions of Anatolia, arboriculture and viticulture were of minor importance on the plateau.

The Middle Bronze Age (ca. 2000-1600 BCE) (Section 1.2.2) might have represented a phase of innovation in central Anatolian agriculture, both at the technological and institutional level (Section 7.4.2). Cereals appear to have represented a commodity, and as such they were involved at the various level of the economic system recorded in the texual record from the Old Assyrian trading colonies (Section 2.3.2). I have, in particular, emphasized the occurrence in debt notes from *Kaneš* of large quantities of grains. Loans of cereal, perhaps as part of an agricultural-credit, could have exacerbated social stratification, given the inclusion of both land and personal freedom as collaterals. These processes appear to have occurred outside the immediate palatial context. On the contrary, available evidence suggest that the political economy of the central authority was in continuum with the older (EBA) tradition, likely without executing any form of direct control of agricultural production.

In several regards, the Late Bronze Age (1600-1180 BCE) (Section 1.2.3) is in discontinuity to the earlier political economy (Section 7.5.2). Textual and archaeological evidence suggests that staple finances acquire a new centrality in the political economy of the Hittite Kingdom. The Hittite polity confronted the productive limits of the Anatolian Plateau through a set of institutional and infrastructural innovations, aimed at expanding production, increasing productivity, and buffering the impact of the cyclically occurring agricultural droughts. These innovations could have played a crucial role in the successful establishment of the Hittite polity – the first (and last) supraregional power centered on the Anatolian plateau. The collapse of the Hittite Empire, around 1180 BCE, is likely to be connected to a plurality of concomitant factors. Within this multicausal framework, I have suggested to include a contraction in agricultural production – which could be reconstructed on the basis of textual sources. More specifically, I have argued that the infrastructures that were successfully planed in order to buffer cyclically occurring droughts could have failed in contrasting a prolonged dry climatic phase.

In the aftermath of the collapse of Hatti, the Anatolian plateau reverted to a fragmented political landscape (Section 1.2.4). Different regions appears to have followed different trajectories, with different degrees of continuity (either direct or indirect) in respect to the Late Bronze Age, Hittite, tradition (Section 1.2.4). In this dissertation, I have proposed that these processes involved also agricultural production (Section 7.6.2). Staple finances appears to have played a more marginal role in the political economy of the Kingdom of Phrygia, which a possible greater role played by textile and metal production. Conversely, in the political economies of Iron Age southcentral Anatolia agricultural, staples could have retained a central role – as documented by the large-scale granaries from Niğde-Kınık Höyük, the associated rich agricultural landscape, and the coeval epigraphic record from the southern Cappadocia.

The aforementioned changes in the role played by agricultural production in Anatolian political economies are coupled with an equally dynamic trend in the crop assemblage (Section 7.2.1). On a qualitative basis, single crops appear to have been introduced in central Anatolian farming at different chronological stages. Starting from the Early Bronze Age (ca. 3000-2000 BCE) viticulture become a stable, although in most instances economically marginal, component of the central Anatolian agricultural landscape (Section 7.3.1). Leaving aside singular occurrences in earlier context, millets (broomcorn and foxtail) appears to have gained a role in the regional farming from the Iron Age onwards (Section 7.6.1). A further crop that could have been introduced in the course of the 1st millennium BCE is Russian olive, first attested in the wood charcoal and carpological record from Niğde-Kınık Höyük during period KH-P III (ca. 500-200 BCE). I have speculated that the introduction of this latter crop could be associated with the incorporation of the Anatolia under Persian rule (Section 6.4.1).

If the introduction of new crops il limited to singular taxa, which do not seem to gain a centrality in local farming systems, a greater degree of diachronic changes is noticeable on a quantitative basis – most notably in the cereal record. The period covered by the dissertation overlaps with the switch in emphasis from hulled (einkorn and emmer) to free-threshing wheat cultivars. In comparison to emmer, einkorn seems to have lost economic importance at an earlier stage, possibly starting from the Middle Bronze Age (Section 7.4.1). On the contrary emmer represented a staple crop also during the Middle and Late Bronze Age (Section 7.5.1). From the Iron Age onwards, free-threshing wheat appears to have fully replaced hulled cultivars in the Anatolian Plateau (Section 7.6.1). This general trend is punctuated by singular resurgences in hulled wheat cultivation, which could be explained either by local traditions, changes in preferences, or by the taphonomy of the sampled deposits. On a supraregional scale, the replacement of hulled wheats by free-threshing forms appears to have been a rather gradual and slow trend. It is still unclear how these processes occurred and under which agency. These questions represent a main avenue where to direct future research (e.g., Marston 2021).

The archaeobotanical sampling of Anatolia is still too lacunose (Section 2.1.3) to allow to investigate the aforementioned trends at a finer scale. The study of quantitative rather than qualitative changes requires, in fact, to be grounded on an adequate dataset, on which basis it could be possible to develop more solid considerations on the geographic and chronological articulation of these processes. In short, changes in the long-duree of agricultural practice could be investigated only by means of an extensive dataset. Big narratives necessitate of big data. Despite the recent intensification in research, the Anatolian Plateau remains unsatisfactory covered by archaeobotanical research (Section 2.1.3). This dissertation contributed on these regards by providing a new archaeobotanical sequence, which covers a period otherwise poorly investigated – the late 2nd and 1st millennia BCE.

"Zooming in": agriculture in southern Cappadocia

The broader view on Anatolian agriculture, sketched in the previous paragraphs and discussed in Chapter 7, has been complemented by a detailed analysis of a more limited geographic and chronological context: southern Cappadocia during the late 2nd and 1st millennia BCE (Part II). This component of the dissertation is grounded on an original archaeological (Chapter 4) and archaeobotanical (Chapter 5 and 6) research I have conducted at the site of Niğde-Kınık Höyük.

Different lines of evidence indicate that agricultural production played a pivotal role in the political economy of 1st millennium BCE southern Cappadocia. During the Early-to-Middle Iron Age, this centrality of staple finances is best documented in the large-scale granaries from Niğde-Kınık Höyük (Chapter 4), which indicate the presence at the site of an institution (which nature to date remains unknown) interested and able to extract and manage large quantities of agricultural staples. The importance of agricultural production in southern Cappadocia during the Middle Iron Age is well-corroborated by the local epigraphic corpus (Section 3.3.2). Of particular note is the attestation of the cult of the Storm God of the Vineyard – a deity represented in association to cereal and grapes in several reliefs and inscriptions from the region (e.g., Section 6.4.4). Leaving aside the question of the origin of this cult, the rulers of the kingdom of Tuwana – especially during the dynasty of Warpalawas – directly associated themselves to the topos of agricultural production, via the deity.

The rock relief from Ivriz represents the most monumental and well-known representation of the Storm God of the Vineyard. Of particular interest is the location of this landscape monument in proximity to a spring, which could symbolically connect the rich agricultural landscape of southern Cappadocia to the local hydrographic setting. Southern Cappadocia is an endorheic basin (Section 3.1.3), characterized despite the semi-arid climate by a comparatively richness in water sources. Evidence of irrigation is to date limited to a possible canal intercepted in proximity to Niğde-Kınık Höyük and dated to the mid-1st millennium BCE (Castellano et al., forthcoming). Water management work are, nevertheless, extensively documented during later chronological periods, most notably in the famous Roman aqueduct of Tyana and the water-reservoir near Bahçeli (Berges and Nollé 2000).

In addition to free-threshing (bread) wheat (Section 6.4.1), viticulture was an hallmark of the agricultural landscape orbiting around Niğde-Kınık Höyük. The importance of viticulture at the site is in close agreement with the iconographic and textual records from southern Cappadocia (Section 6.4.4). Carpological (Section 6.4.1) and anthracological (Section 5.4.3) evidence indicates that viticulture peaked in the second half of the 1st millennium BCE. I have proposed that this momentum in viticulture activities at Kınık Höyük could be associated to the presence at the site of a cultic institution, directly involved in agricultural production (Section 6.4.3). The presence of a sanctuary at the site during period KH-P III (ca. 500-200 BCE) and KH-P IIB (200-1 BCE) is documented by archaeological evidence (Trameri and d'Alfonso 2020, d'Alfonso et al 2020). Strabo informs on the occurrence in Hellenistic Cappadocia of large sanctuary controlling large agricultural estates, possibly continuing an older Anatolian tradition of cultic centers as economic foci (Section 2.3.4). It is, thus, tempting to recognize in one of such institutions a possible actor in promoting the flourishing of the local agricultural landscape. I have proposed (Section 2.4.4) that wine-making could have represented the main focus of viticulture at the site, perhaps fulfilling local demands and directed towards central Anatolian markets.

The second half of the 1st millennium BCE is unfortunately very poorly covered by archaeobotanical research, on the Plateau and elsewhere in Anatolia (Section 2.1.3). In addition to Niğde-Kınık Höyük a second archaeobotanical sequence covering this period originate from Gordion (Miller 2010, Marston 2017). A comparison of these intensive studied records documents the presence of two well-distinct agricultural systems, which could have been rooted into specific ecological and political-economic settings (Section 7.7.2). This evidence ultimately suggest the presence of a high degree of specialization in central Anatolian economies, which underlies the general macroregional trajectory.

As discussed by Marston (2021), in comparison to the study of the origin of agriculture, the investigation of the later development in agricultural economies has been somehow overlooked in the western Asian scholarship. Central Anatolia is an emblematic example on these regards, given a traditional centrality of the topic of the emergence of the first agricultural societies (e.g., Baird et al. 2018). With this dissertation, I hope that I was able to prove that the study of agricultural systems should claim a centrality also in scholarship on the later protohistoric and historical periods.

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APPENDIX 1

The Anatolian Archaeobotanical Literature: Carpological Analysis

In this appendix I am reporting the available archaeobotanical sequences with published carpological data from Anatolia (modern Turkey), including all periods, chronologies, and publications formats. These sequences are discussed in Chapter 2 and Chapter 7 of the dissertation.

Code: site codes used in figures and tables throughout the dissertation

Site: site name, as reported in the literature

Region: sites were assigned to eight eco-regions, defined following Atalay 20141

Coordinates: geographic coordinates (WGS 1984) and elevation asl. The coordinates are to be considered approximative for sites submerged during dam construction projects, shipwrecks, and other sites impossible to locate using the published evidence.

Year-prec: modern average yearly precipitation (mm). Values extracted from the worldclim2 30seconds dataset (Fick and Hijmans 2017).

Jan-T: modern average January temperature (°C). Values extracted from the worldclim2 30seconds dataset (Fick and Hijmans 2017).

Jul-T: modern average July temperature (°C). Values extracted from the worldclim2 30seconds dataset (Fick and Hijmans 2017).

Chronology-Final Data: chronological phases for which the published archaeobotanical evidence meets the following criteria: (*i*) it contains carpological data; (*ii*) data are quantitatively published (either as counts or weights); (*iii*) the chronological phasing of the archaeobotanical samples is sufficiently precise to attribute their results to periods no broader than here defined (see below); (*iv*) the report of the data is publicly available; theses not available in online repositories were excluded.

Chronology-Preliminary Data: chronological phases for which the published archaeobotanical evidence does not meet the above listed criteria.

References: bibliographic references.

Chronology abbreviations: Epipal.= Epipaleolithic; PPN= Aceramic Neolithic; Neoli.= Neolithic; ECh.= Early Calcolithic; MCh.= Middle Chalcolithic; LCh.= Late Chalcolithic; EBA= Early Bronze Age; MBA = Middle Bronze Age; LBA= Late Bronze Age; IA= Iron Age (including Achaemenid); Hell.=Hellenistic; Rom.=Roman; Med.I = Early/Middle Byzantine, Abbasid; Med.II = Late Byzantine/Seljuk and Ottoman.

Code	Site	Region	Coordinates			Climate			Chronology (archaeobotany)		References
			North	East	asl	year-prec	jan-T	july-T	Final data	Preliminary data	
c1	Alaca Höyük	C-Anatolia	40.234444	34.695556	1080	492	-1.4	19.7		LBA	Dix 1938 and 1944; Gökgöl 1938 and 1944
c2	Alişar Hüyük	C-Anatolia	39.606111	35.261389	1126	436	-1.4	20.4		Ch, IA	Harlan et al. 1937
c3	Amorium	C-Anatolia	39.020556	31.289167	940	419	0.4	21.5	Med. 1	Rom., Med. I, Med. II	Giorgi 2012; Harrison 1993; Lightfoot et al. 1995; Giorgi 2011
c4	Aşıklı Höyük	C-Anatolia	38.348889	34.23	1118	343	-0.3	21.6	PPN		Ergun et al. 2018; van Zeist and de Roller 2003a; Ergun 2018; van Zeist and de Roller 1995
c5	Boğazköy	C-Anatolia	40.010212	34.616159	1206	490	-1.3	19.8	MBA, LBA	IA	Diffey et al. 2020; Pasternak 2012; Diffey et al. 2017; Dörfler et al. 2000; Hopf 1992; Neef 2001
c6	Boncuklu	C-Anatolia	37.751735	32.864805	1050	453	0.3	21.2	PPN		Baird et al. 2018
c7	Boyalı Höyük	C-Anatolia	40.317543	34.283627	750	433	0.2	22.4	MBA		Salih et al. 2009
c8	Büklükale	C-Anatolia	39.583251	33.428274	785	390	0.7	23.4	MBA		Fairbairn et al. 2019
c9	Çadır Höyük	C-Anatolia	39.676797	35.143431	1020	440	-0.8	20.9	LCh	EBA, MBA, LBA, IA, Med. II	von Baeyer et al. 2021; Cassis et al. 2019; Chernoff and Taska 1996; Ross et al. 2019; Smith 2007; Steadman et al. 2019a, 2019b, and 2019c; von Baeyer 2018
c10	Çamlıbel Tarlası	C-Anatolia	40.010212	34.616159	1206	490	-1.3	19.8	LCh		Stroud 2016; Papadopoulou and Bogaard 2012
c11	Can Hasan I	C-Anatolia	37.262903	33.331232	1017	414	0.6	22.1	MCh		Stroud 2016
c12	Can Hasan III	C-Anatolia	37.279114	33.322985	1011	415	0.6	22.2		PPN, Med. II	Hillman 1972 and 1978; Renfrew 1968; Fairbairn 2019b
c13	Çatalhöyük	C-Anatolia	37.666823	32.827914	1016	461	0.5	21.1	PPN, Neol., ECh		Bogaard et al. 2017; Bogaard et al. 2009 and 2013; Eastwood et al. 2018; Fairbairn 2005; Fairbairn et al. 2002, 2005, and 2007b; Filipović 2012, 2014, and 2016; Green et al. 2018; González Carretero et al. 2017; Hastorf 2005; Helbaek 1964; Stroud 2016; Twiss et al. 2009; Stroud et al. 2021; Bogaard et al. 2021
c14	Demircihöyük	C-Anatolia	39.85035	30.27052	845	471	0	20.4	EBA		Schlichtherle 1977
c15	Gordion	C-Anatolia	39.650472	31.978199	693	377	1.4	23.3	MBA, LBA, IA, Hell., Rom., Med. I, Med. II		Marston 2017; Marston and Miller 2014; Miller 2010; Miller 1999
c16	Kaman-Kalehöyük	C-Anatolia	39.362778	33.786667	1070	445	-1	20.5	MBA, Med. II	IA	Fenwick and Omura 2015; Kennedy 2000; Nesbitt 1993; Fairbairn 2002, 2003, 2004, 2006; Fairbairn et al. 2007b; Fairbairn and Bradley 2008; Nesbitt 1995
c17	Kanlıtaş Höyük	C-Anatolia	39.697407	30.083118	950	518	-0.2	19.9		ECh., MCh., LCh.	Kavak et al 2018a and 2019a
c18	Kerkenes	C-Anatolia	39.75	35.065556	1300	497	-1.7	19.7	IA		Marston and Branting 2016; Smith and Branting 2014
c19	Kınık Höyük	C-Anatolia	37.937441	34.380126	1110	366	0.5	22.2		LBA, IA, Hell., Med. II	*this study*; Highcock et al. 2015
c20	Küllüoba	C-Anatolia	39.556242	30.744197	935	427	-0.4	21.1	EBA		Çizer 2015
c21	Kültepe	C-Anatolia	38.850643	35.634729	1100	394	-2	20.5	EBA, MBA		Fairbairn 2014; Fairbairn and Wright 2017; Fairbairn et al. 2013
c22	Kuşaklı	C-Anatolia	39.308333	36.909722	1652	436	-5.2	17.1	LBA, IA		Müller-Karpe et al. 1995, 1998, and 2000
c23	Musular	C-Anatolia	38.358402	34.219631	1100	341	-0.2	21.5		Neol.	Özbasaran 2000; Özbasaran and Endoğru 2001
c24	Ortaköy	C-Anatolia	40.255008	35.236028	790	445	0.2	20.8	LBA		Oybak Dönmez 2019
c25	Pessinonte	C-Anatolia	39.333889	31.584444	940	405	0.8	21.8	Hell., Rom., Med I		van Peteghem 2005 and 2008; van Peteghem and Braeckman 2001
c26	Pınarbaşı	C-Anatolia	37.479588	33.021583	1120	438	0.3	22.1	PPN		Baird et al. 2013; Fatrbairn et al. 2014; Baird et al. 2018
c27	Tepecik-Çiftlik	C-Anatolia	38.171944	34.493611	1570	356	-3	18.4		Neol., ECh.	Alshawish 2018
n1	İkiztepe	N-Anatolia	41.611933	35.867915	38	742	6.1	22.8	LCh., EBA, MBA		van Zeist 2003; Çilingir 2009
n2	Komana-Pontika	N-Anatolia	40.3575	36.638611	640	464	2.1	21.6	Med. I, Med. II		Piskin and Tatbul 2015; Erciyas and Tatbul 2016
n3	Oymaağaç	N-Anatolia	41.207728	35.429287	280	576	3.3	22.1	EBA, LBA, IA, Hell./Rom., Med. I		Czichon et al 2011, 2017, 2019; Ulaş 2019a
ma1	Aktopraklık	Marmara	40.173302	28.770897	102	615	5	23.3		Neol., ECh	Schroedter and Nelle 2015
ma2	Barcın Höyük	Marmara	40.266973	29.602058	229	529	4	23.2		Neol.	Balci et al. 2019
ma3	Daskeleion	Marmara	40.128889	28.071667	40	680	5	23.1	Med. I	IA, Hell.	Oybak Dönmez et al. 2016; Oybak Dönmez et al. 2014
ma4	Ilipinar	Marmara	40.275709	29.521437	240	540	4	23	ECh.		Cappers 2008; van Zeist and Waterbolk-van Rooijen 1995; Cappers 2001

Code	Site	Region	Coordinates			Climate			Chronology (archaeobotany)		References
			North	East	asl	year-prec	jan-T	july-T	Final data	Preliminary data	
ma5	Küçükyalı	Marmara	40.943576	29.115447	10	704	5.9	23.7	Med. II	Med. I	Ulaş 2017a; Ulaş 2020b
ma6	Yassi Ada	Marmara	40.864791	28.993247	0	684	6.1	22.3	Med. I		Bryant et al 1982
ma7	Yenikapi	Marmara	41	28.95	5	710	6.2	23.9	Med. I	Neol.	Oybak-Dönmez 2010, Ulas 2020a
ma8	Pendik Höyük	Marmara	40.871394	29.25595	5	732	5.9	23.8		Neol	Ulaş 2020a
ma9	Beşiktaş	Marmara	41.068616	29.028535	128	704	5.9	23.7	Med I		Ulaş 2020b
m10	Aydos Castle	Marmara	40.931111	29.256944	450	704	5.9	23.7	Med II		Ulaş 2020b
ma11	Dikilitaş	Marmara	40.487523	29.702014	130	616	5.3	23.6	Med II		Willcox 2003
ma12	Ayazmaçukur	Marmara	40.487523	29.702014	130	616	5.3	23.6	IA, Hell		Willcox 2003
a1	Bakla Tepe	Aegean	38.159722	27.145556	50	682	8.4	26.7	LCh, EBA		Oybak Dönmez and Doğan 2008; Erkanal and Özkan 1999
a2	Çukuriçi Höyük	Aegean	37.929167	27.359444	28	698	8.5	26.2	LCh, EBA		Horejs et al. 2011; Horejs et al. 2008
a3	Ephesus	Aegean	37.941111	27.341944	15	699	8.4	25.9	Hell., Rom.		Heiss and Thanheiser 2016 and 2020; Popovtschak 2001
a4	Hierapolis	Aegean	37.925	29.125833	370	574	5.9	25.8	Med. I		Fiorentino et al. 2012; Fiorentino 2016
a5	Kaymakçı	Aegean	38.623436	27.929764	200	615	6.6	26.7	LBA		Shin et al. 2021; Roosevelt et al 2018
a6	Kümtepe	Aegean	39.937607	26.194046	10	587	6.7	24.9	MCh., LCh.		Riehl 1999a
a7	Liman Tepe	Aegean	38.363333	26.775833	2	611	8.9	26.7	LCh., EBA		Oybak-Dönmez and Doğan 1997; Oybak Dönmez 2006a
a8	Miletus	Aegean	37.530278	27.278333	10	699	9.6	27.6	IA		Stika 1997; Yalcin 1994 and 1996
a9	Serçe Limanı	Aegean	36.584596	28.048723	0	832	11.6	26.2	Med. I		Ward 2004
a10	Bozburun	Aegean	36.728033	28.071252	0	900	11.2	26.4	Med. I		Gorham 2000
a11	Troy	Aegean	39.957461	26.238561	30	596	6.5	25.1	EBA, MBA, LBA, IA		Riehl 1999a; Riehl 1999b, Lindau 1922, Wittmack 1880 and 1890, Schiemann 1951, Jablonka et al. 1994, Shay et al. 1982
a12	Ulucak	Aegean	38.466623	27.352356	215	722	6.9	26.4	Neol.		Megaloudi 2005
a13	Yenibademli Höyük	Aegean	40.217224	25.895664	15	648	7	24.5	EBA		Oybak Dönmez 200512/24/2021 Oybak Dönmez 2014
m1	Dumuztepe	Mediterranean	37.320981	37.035681	545	632	5.1	28.6	ECh.		Kansa et al. 2009; Campbell et al. 1999
m2	Karain B	Mediterranean	37.077778	30.570833	400	633	6.1	26.6	Epipal.		Martinoli 2004
m3	Kilise Tepe	Mediterranean	36.480505	33.547757	120	656	8.4	28.4	LBA, IA, Med. II	MBA, Hell.	Bending and Colledge 2007 ; Colledge 2001; Bouthillier et al 2014
m4	Kinet Höyük	Mediterranean	36.853637	36.157192	10	820	10.7	27.9	LBA, Med. I, Med. II	IA	Çizer 2006; Ramsay and Eger 2015
m5	Mersin-Yumuktepe	Mediterranean	36.801164	34.604313	38	662	10.5	27.3	Neol., MCh., EBA, Med. I		Fiorentino et al. 2014; Ulaş and Fiorentino 2020; Ulaş 2019b; Fiorentino 2004; Fiorentino and Ulaş 2017; Garstang 1953; Ulaş 2017b; Ulaş and Fiorentino 2010
m6	Öküzini	Mediterranean	37.088935	30.576167	430	645	6.3	26.9	Epipal.		Martinoli 2004; Martinoli 2002
m7	Sirkeli Höyük	Mediterranean	37.00328	35.74387	44	744	9.8	28.3	IA		Sollee et al. 2020
m8	Tarsus-Gözlükule	Mediterranean	36.91243	34.895952	30	701	10	27.3		LBA, Med. II	Özyar et al. 2020
m9	Tatarlı Höyük	Mediterranean	37.125404	36.053202	40	802	10.1	28.7	Hell.	MBA, LBA, IA	Aslan et al. 2014, Kavak et al. 2019b; Aslan 2012; Kavak et al. 2014, 2017, and 2018
m10	Tell Atchana	Mediterranean	36.237778	36.384722	95	778	9.3	28	LBA		Çizer 2006; Riehl 2010; Welton et al. 2019
m11	Tell Kurdo	Mediterranean	36.337244	36.320517	75	829	9.6	27.9	MCh.		Ekstrom 2004; Ekstrom 2000
m12	Tell Tayinat	Mediterranean	36.248116	36.375858	95	788	9.4	28	EBA, IA		Karakaya 2019; Capper 2012; Welton et al. 2019
m13	Tilmen Hoyuk	Mediterranean	37.03001	36.704524	460	739	5.8	28.4		MBA	Carra 2013
m14	Ulu Burun	Mediterranean	36.128611	29.685833	0	803	11.5	26.9	LBA		Haldane 1993, Ward 2003
tm1	Bademağacı Höyük	Tr-Mediterranean	37.212595	30.474898	800	517	3.6	24.2		Neol., ECh., EBA	Fairbairn 2019a
tm2	Beycesultan	Tr-Mediterranean	38.256668	29.701197	833	535	2.9	22.8	LBA, Med. I		Helbaek 1961
tm3	Boz Höyük	Tr-Mediterranean	38.148121	30.039572	838	496	3	23.1		EBA	Wittmack 1896
tm4	Düzen Tepe	Tr-Mediterranean	37.664503	30.505889	1600	587	-0.2	20.3		IA, Hell.	Cleymans et al. 2017; De Cupere et al. 2017; Fuller et al. 2012; Vanhaverbeke et al. 2010
tm5	Erbaba	Tr-Mediterranean	37.7597007	31.6812895	1135	601	0.5	22.4	Neol.		van Zeist and Buitenhuis 1983
tm6	Hacılar	Tr-Mediterranean	37.584396	30.084453	920	492	2.7	23.2		Neol., ECh.	Helbaek 1970
tm7	Höyücek Höyük	Tr-Mediterranean	37.455006	30.559446	795	526	3.4	24.3	Neol.		Martinoli and Nesbitt 2003
tm8	Kuruçay Höyük	Tr-Mediterranean	37.642502	30.164221	920	489	2.8	23.2	LCh.		Stroud 2016; Nesbitt 1996

Code	Site	Region	Coordinates			Climate			Chronology (archaeobotany)		References
			North	East	asl	year-prec	jan-T	july-T	Final data	Preliminary data	
tm9	Sagalassos	Tr-Mediterranean	37.678056	30.519444	1550	608	-0.8	19.6	Med. I	Hell., Rom.	Baeten et al. 2012; Poblome et al. 2015; Waelkens 2004 and 2005; Waelkens et al. 2010, 2013 and 2014; Vandam et al. 2019; Verstraeten et al. 2011
se1	Akarçay Tepe	SE-Anatolia	36.918889	38.025278	356	366	5.9	30		PPN	Buxó and Rovira 2007; Özbaşaran et al. 2007
se2	Çayönü Tepesi	SE-Anatolia	38.218139	39.72542	825	591	1.8	29.3	PPN, Neol.		van Zeist and de Roller 2003b; Braidwood et al. 1981; Stewart 1976; van Zeist 1972; van Zeist and de Roller 1992
se3	Demirköy	SE-Anatolia	37.931381	41.094921	545	618	2.6	30.1		PPN	Savard et al. 2006
se4	Fıstıklı Höyük	SE-Anatolia	36.995667	37.977722	350	377	5.8	30.2		ECh.	Allen 2019; Bernbeck and Pollock 2003
se5	Girikihaciyan	SE-Anatolia	38.147299	39.981567	785	585	1.7	29.8	MCh.		van Zeist 1979
se6	Göbekli Tepe	SE-Anatolia	37.223215	38.922422	777	503	4.6	30.8	PPN		Neef 2003
se7	Gre Virike	SE-Anatolia	36.91738886	38.01724035	350	362	6	29.9	EBA, Med. II		Oybak Dönmez 2006c; Oybak Dönmez 2006b
se8	Gritille	SE-Anatolia	37.55643079	38.57204025	525	518	5.9	29	PPN, Med. I		Miller and Redford 1998; Miller 1999; Miller 1992
se9	Gusir Höyük	SE-Anatolia	37.727194	41.821181	535	640	4.3	31.5	PPN		Kabukcu et al. 2021
se10	Hacinebi	SE-Anatolia	37.060528	37.977529	390	401	5.7	30.5	LCh.		Stein et al. 1996a and 1996b; Miller 1994
se11	Hallan Çemi Tepesi	SE-Anatolia	38.224167	41.241667	650	660	1.6	29.7	Epipal.		Savard 2018; Rosenberg et al 1995; Rosenberg et al 1998; Savard et al. 2006
se12	Hasankeyf Höyük	SE-Anatolia	37.714722	41.413055	550	607	3.5	31.3		PPN	Miyake et al. 2012
se13	Hassek Höyük	SE-Anatolia	37.74823351	38.92272558	530	488	5.1	29.8		LCh., EBA	Gregor 1992
se14	Hirbemerdon Tepe	SE-Anatolia	37.77737	41.014002	530	588	2.9	30.4	MBA		Laneri et al. 2008; Lanieri et al. 2015
se15	Horum Höyük	SE-Anatolia	37.109201	37.861011	340	413	5.5	30.1		EBA, MBA	Herveux 2007
se16	Ilısu Höyüğü	SE-Anatolia	37.527068	41.845406	525	607	5.4	32.3	Rom.		Oybak Dönmez 2018
se17	Karkemish	SE-Anatolia	36.829722	38.015	350	338	6	30.5	LBA, IA, Hell., Med. I		Carra 2018
se18	Kenan Tepe	SE-Anatolia	37.830561	40.813238	560	572	2.6	30	MCh.		Graham 2011; Graham and Smith 2013; Parker et al. 2003
se19	Körtik Tepe	SE-Anatolia	37.815746	40.988055	520	585	2.9	29.8	Epipal., PPN		Rössner et al. 2018; Benz et al. 2013l Benz et al. 2015; Coşkun et al. 2012; Rhiel et al. 2012
se20	Kurban Höyük	SE-Anatolia	37.48110496	38.42187062	530	516	6.1	29		LCh., EBA	Miller 1986
se21	Kuriki Höyük	SE-Anatolia	37.79133	41.011856	520	585	3	30.3		LCh.	Çakan et al 2014
se22	Mezraa Höyük	SE-Anatolia	36.972338	37.975654	340	365	5.9	30.2	EBA, MBA, Med. II		Oybak Dönmez 2006c
se23	Nevalı Çori	SE-Anatolia	37.518333	38.605556	559	515	5.4	29.4	PPN		Pasternak 1998
se24	Oylum Höyük	SE-Anatolia	36.699142	37.17855	660	459	5.2	28.8		Ch.	Pasternak 1997
se25	Salat Tepe	SE-Anatolia	37.839534	40.901777	540	580	2.7	30	MBA		Ökse et al. 2012
se26	Sumaki Höyük	SE-Anatolia	37.916495	41.293559	740	682	2.3	30.2	Neol.		Kutlu et al. 2018
se27	Tilbeşar	SE-Anatolia	36.874	37.559	615	410	4.7	29.1	EBA		Kavak et al. 2019b
se28	Tille Höyük	SE-Anatolia	37.73359544	38.88293575	560	507	4.8	30.2	LBA, IA, Hell.		Nesbitt 2016
se29	Titriş Hoyuk	SE-Anatolia	37.476045	38.67599514	580	521	5	30.2	EBA		Hard 2010; Algaze et al. 1995; Algaze et al. 2021
se30	Yarım Höyük	SE-Anatolia	37.01396	37.957899	350	384	5.8	30.6	LCh.		Rothman et al 1998
se31	Zeugma	SE-Anatolia	37.058611	37.865833	524	394	5.7	30.4	Rom.		Challinor and de Moulins 2013
se32	Zeviya Tivilki	SE-Anatolia	37.534307	41.81953	530	621	5.2	32	IA		Oybak Dönmez 2014
se33	Ziyaret Tepe	SE-Anatolia	37.79347	40.793047	560	561	2.7	29.9	EBA, MBA, LBA, IA, Med. I		Rosenzweig 2014; Greenfield and Rosenzweig 2014, Matney et al. 2015
e1	Arslantepe	E-Anatolia	38.381944	38.361111	911	440	0.4	27	LCh, EBA		Balossi et al. 2010; Follieri and Coccolini 1983; Mir Makhamad 2009Palumbi et al. 2017; Piccione et al. 2015; Sabanov 2018; Sadori et al. 2006; Vignola et al. 2014; Belisario et al. 1994: Sadori and Masi 2012
e2	Aşvan (multi-site)	E-Anatolia	38.899589	38.950008	821	503	1.5	27.3	MCh, LCh, EBA, LBA Hell., Rom., Med. I, Med. II		Nesbitt et al. 2017; van Zeist 1998
e3	Ayanis	E-Anatolia	38.707778	43.211667	1835	472	-4.7	21.5	IA		Cocharro et al. 2001; Solmaz and Oybak Dönmez 2013; Oybak-Dönmez and Solmaz 2012
e4	Cafer Höyük	E-Anatolia	38.41689391	38.74996083	686	445	2.7	28.1	PPN		de Moulins 1997; de Moulins 1993
e5	İmanoğlu Höyük	E-Anatolia	38.47818714	38.47907367	675	434	2.6	27.1	EBA		Oybak and Demirci 1997

Code	Site	Region	Coordinates			Climate			Chronology (archaeobotany)		References
			North	East	asl	year-prec	jan-T	july-T	Final data	Preliminary data	
e6	Korucutepe	E-Anatolia	38.63552801	39.53166302	820	597	1.5	27.1		LCh., EBA, MBA, LBA, Med. II	van Zeist and Bakker-Heeres 1974 and 1975
e7	Patnos	E-Anatolia	39.235833	42.868611	1640	524	-8.1	21	IA		Oybak Dönmez 2003
e8	Sos Höyük	E-Anatolia	39.99618	41.524462	1750	433	-9.4	19.2	EBA, MBA	LCh., MBA, IA	Longford 2015; Longford et al. 2009, Longford and Sagona 2021
e9	Tepecik- Elazığ	E-Anatolia	38.63552801	39.53166302	820	597	1.5	27.1		EBA, MBA, LBA	van Zeist and Bakker-Heeres 1974 and 1975
e10	Yoncatepe	E-Anatolia	38.573609	43.270268	1670	439	-3.9	22.1	IA		Dönmez and Belli 2007

APPENDIX 2

The Anatolian Archaeobotanical Literature: Anthracological and Xylological Analysis

In this appendix I am reporting the available archaeobotanical sequences with published anthracological or xylological data from Anatolia (modern Turkey), including all periods, chronologies, and publications formats. These sequences are discussed in Chapter 2 and Chapter 7 of the dissertation.

Code: site codes used in figures and tables throughout the dissertation

Site: site name, as reported in the literature

Region: sites were assigned to eight eco-regions, defined following Atalay 20141

Coordinates: geographic coordinates (WGS 1984) and elevation asl. The coordinates are to be considered approximative for sites submerged during dam construction projects, shipwrecks, and other sites impossible to locate using the published evidence.

Year-prec: modern average yearly precipitation (mm). Values extracted from the worldclim2 30seconds dataset (Fick and Hijmans 2017).

Jan-T: modern average January temperature (°C). Values extracted from the worldclim2 30seconds dataset (Fick and Hijmans 2017).

Jul-T: modern average July temperature (°C). Values extracted from the worldclim2 30seconds dataset (Fick and Hijmans 2017).

Chronology-Final Data: chronological phases for which the published archaeobotanical evidence meets the following criteria: (*i*) it contains anthracological or xylological data; (*ii*) data are quantitatively published (either as counts or weights); (*iii*) the chronological phasing of the archaeobotanical samples is sufficiently precise to attribute their results to periods no broader than here defined (see below); (*iv*) the report of the data is publicly available; theses not available in online repositories were excluded.

Chronology-Preliminary Data: chronological phases for which the published archaeobotanical evidence does not meet the aforementioned criteria.

References: bibliographic references.

Chronology abbreviations: Epipal.= Epipaleolithic; PPN= Aceramic Neolithic; Neoli.= Neolithic; ECh.= Early Calcolithic; MCh.= Middle Chalcolithic; LCh.= Late Chalcolithic; EBA= Early Bronze Age; MBA = Middle Bronze Age; LBA= Late Bronze Age; IA= Iron Age (including Achaemenid); Hell.=Hellenistic; Rom.=Roman; Med.I = Early/Middle Byzantine, Abbasid; Med.II = Late Byzantine/Seljuk and Ottoman.

Code	Site	Region	Coordinates			Climate			Chronology (archaeobotany)		References
			North	East	asl	year-prec	jan-T	july-T	Final data	Preliminary data	
c2	Alişar Höyük	**C-Anatolia**	39.606111	35.261389	1126	436	-1.4	20.4		Chalc., IA	Record et al 1937
c5	Boğazköy	C-Anatolia	40.010212	34.616159	1206	490	-1.3	19.8	LBA		Hopf 1992
c6	Boncuklu	C-Anatolia	37.751735	32.864805	1050	453	0.3	21.2	PPN		Kabukcu 2017
c8	Büklükale	C-Anatolia	39.583251	33.428274	785	390	0.7	23.4	MBA		Fairbairn et al. 2019
c9	Çadır Höyük	C-Anatolia	39.676797	35.143431	1020	440	-0.8	20.9	Med. I		Steadman et al 2019c
c10	Çamlıbel Tarlası	C-Anatolia	40.010212	34.616159	1206	490	-1.3	19.8	LC		Marston et al. 2020
c12	Can Hasan III	C-Anatolia	37.279114	33.322985	1011	415	0.6	22.2	PPN		Kabukcu 2017
c13	Çatalhöyük	C-Anatolia	37.666823	32.827914	1016	461	0.5	21.1	PPN, Neol., EC		Asouti and Hather 2001; Fairbairn et al. 2002; Asouti 2005; Asouti 2013; Kabukcu 2017; Kabukcu 2018.
c15	Gordion	C-Anatolia	39.650472	31.978199	693	377	1.4	23.3	LBA, IA, Hell., Roman, Med. I, Med. II		Aytuğ 1988; Aytuğ and Gorcelioğlu 1989; Kayacik and Aytuğ 1968; Miller 2010; Marston and Miller 2014; Marston 2017
c16	Kaman-Kaleöyük	C-Anatolia	39.362778	33.786667	1070	445	-1	20.5	MBA, LBA, IA		Wright et al. 2015 and 2017; Wright 2018
c19	Kınık Höyük	C-Anatolia	37.937472	34.380111	1100	366	0.5	22.2	LBA, IA, Hell., Med. II		Castellano 2021
c21	Kültepe	C-Anatolia	38.850643	35.634729	1100	394	-2	20.5	EBA, MBA		Fairbairn and Wright 2017
c26	Pınarbaşı	C-Anatolia	37.479588	33.021583	1120	438	0.3	22.1	Epipal., PPN, Neol., EC		Asouti 2003; Baird et al. 2013; Kabukcu 2017; Baird et al. 2018.
a3	Ephesus	Aegean	37.941111	27.341944	15	699	8.4	25.9	Hell., Roman, Med. I		Heiss and Thanheiser 2016; Heiss 2016; Heiss and Thanheiser 2020
a5	Kaymakçı	Aegean	38.623436	27.929764	200	615	6.6	26.7	LBA		Marston et al. 2021
a11	Troy	Aegean	39.957461	26.238561	30	596	6.5	25.1	BA		Shay et al. 1992
a13	Yenibademli Höyük	Aegean	40.217224	25.895664	15	648	7	24.5	EBA		Yaman 2011; Yaman and Hüryilmaz 2014
n4	Ilgarini	N-Anatolia	41.70429	33.040436	500	704	0	20		Med. I	Akkem 2004
e1	Arslantepe	E-Anatolia	38.381944	38.361111	911	440	0.4	27	LC, EBA		Frangipane et al 2001; Sadori et al. 2006; Sadori et al 2008; Alvaro et al 2010; Masi et al 2018;
e2	Aşvan-Aşvan Kale	E-Anatolia	38.899589	38.950008	821	503	1.5	27.3	EBA, LBA, Hell., Roman, Med. II		Willcox 1974
e2	Aşvan-Çayboyu	E-Anatolia	38.899589	38.950008	821	503	1.5	27.3	LC		Willcox 1974
e2	Aşvan-Taşkun Kale	E-Anatolia	38.899589	38.950008	821	503	1.5	27.3	Med. II		Willcox 1974
e2	Aşvan-Taşkun Mevkii	E-Anatolia	38.899589	38.950008	821	503	1.5	27.3	EBA		Willcox 1974
e4	Cafer Höyük	E-Anatolia	38.41689391	38.74996083	686	445	2.7	28.1	PPN		Willcox 1991
e6	Korucutepe	E-Anatolia	38.63552801	39.53166302	820	597	1.5	27.1	LC,EBA, MBA, LBA, Med. II		van Zeist and Bakker-Heeres 1974; van Zeist and Bakker-Heeres 1975;
e8	Sos Höyük	E-Anatolia	39.99618	41.524462	1750	433	-9.4	19.2	LC, MBA, EIA		Longford et al. 2009
e10	Onar	E-Anatolia	38.970116	38.572022	1210	642	-1.7	25.7		Med. II	Akkemik et al. 2019
ma1	Aktopraklık	Marmara	40.173302	28.770897	102	615	5	23.3	Neol., EC		Schroedter and Nelle 2015
ma3	Daskeleion	Marmara	40.128889	28.071667	40	680	5	23.1		Hell.	Yaman et al. 2013
ma7	Yenikapi	Marmara	41	28.95	5	710	6.2	23.9	Med I		Akkemik and Kocabaş 2014; Akkemik 2015
ma9	Juliopolis	Marmara	40.066667	31.666667	460	418	2.9	24.4		Roman	Akkemik and Metin 2011
ma11	Dikilitaş	Marmara	40.487523	29.702014	130	616	5.3	23.6	Med II		Willcox 2003
ma12	Ayazmaçukur	Marmara	40.487523	29.702014	130	616	5.3	23.6	IA		Willcox 2003
m2	Karain B	Mediterranean	37.077778	30.570833	400	633	6.1	26.6	Epipal.		Martinoli 2009
m6	Okuzini	Mediterranean	37.088935	30.576167	430	645	6.3	26.9	Epipal.		Thiébault 2002; Emery-Barbier and Thiébault 2005; Martinoli 2009
m10	Tell Atchana	Mediterranean	36.237778	36.384722	95	778	9.3	28	LBA		Deckers 2010
m13	Tilmen Hoyuk	Mediterranean	37.03001	36.704524	460	739	5.8	28.4	MBA		Macchioni and Lazzeri 2013
m14	Ulu Burun	Mediterranean	36.128611	29.685833	0	803	11.5	26.9	LBA		Warnock and Pendleton 1991
m15	Olba	Mediterranean	36.584393	33.925734	1200	649	1.3	22.2		nr	Yaman et al. 2017
se1	Akarçay Tepe	SE-Anatolia	36.918889	38.025278	356	366	5.9	30	PPN, Neol., EC		Pique and Mensua 2009
se2	Çayönü Tepesi	SE-Anatolia	38.218139	39.72542	825	591	1.8	29.3	PPN, Neol.		van Zeist and de Roller 1992
se6	Göbekli Tepe	SE-Anatolia	37.223215	38.922422	777	503	4.6	30.8	PPN		Neef 2003
se10	Hacinebi	SE-Anatolia	37.060528	37.977529	390	401	5.7	30.5	LC		Miller 1994
se11	Hallan Çemi Tepesi	SE-Anatolia	38.224167	41.241667	650	660	1.6	29.7		PPN	Rosemberg et al. 1998
se15	Horum Höyük	SE-Anatolia	37.109201	37.861011	340	413	5.5	30.1	EBA, MBA		Willcox 2002; Deckers and Pessin 2010

Code	Site	Region	Coordinates			Climate			Chronology (archaeobotany)		References
			North	East	asl	year-prec	jan-T	july-T	Final data	Preliminary data	
se19	Körtik Tepe	SE-Anatolia	37.815746	40.988055	520	585	2.9	29.8	Epipal., PPN		Coşkun et al. 2012; Benz et al. 2013, Benz et al 2015; Rössner et al. 2018
se20	Kurban Höyük	SE-Anatolia	37.48110496	38.42187062	530	516	6.1	29	EBA		Algaze et al. 1986
se27	Tilbeşar	SE-Anatolia	36.874	37.559	615	410	4.7	29.1	EBA, MBA, Med I		Kavak et al. 2018; Willcox 2002; Deckers and Pessin 2010
se32	Zeviya Tivilki	SE-Anatolia	37.534307	41.81953	530	621	5.2	32		IA	Yaman 2014

APPENDIX 3

List of archaeobotanical samples from Niğde-Kınık Höyük included in the dissertation project

In this appendix I am reporting the metadata and metrics of the samples included in the archaeobotanical study I have presented in Chapter 5 and Chapter 6 of the dissertation.

The samples selected for this study were processed using manual ('wash-over technique' and 'bucket flotation', Pearsal 2000: 50-51) and machine assisted (Siraf-Type, Williams 1973) flotation. Machine flotation was introduced at a later stage of the project, to maximize the amount of sediment that could be processed in an excavation season. Flotation was conducted using local aqueduct water, available at the excavation house.

For the absolute dating of the Niğde-Kınık Höyük periods see Chapter 3 (especially Table 3.1). In the columns 4, 2, 1, 0.5, 0.25 mm it is reported the volume of the floated debris for each sieving fraction. In the column status, "all" indicates that all the charcoal fragments > 4 mm have been analyzed.

Abbreviations used in the table: *only part of the charcoal in the 4mm fraction are analyzed; # Char. = number of charcoal fragments analyzed; # Carp. = number of seed/fruit remains analyzed; a= abundant modern uncharred material is present in the light fraction; b= significant quantity of sediment in the light fraction; c= several very large charcoal fragments are not considered in volume calculation

SAMPLE	**trench**	**unit**	**unit type**	**unit class**	**level/phase**	**period**	**preparation**	**soil (ml)**	**LF (ml)**	**# Char.**	**# Carp.**	**notes**
KIN16B2169s11	B	2169	layer (accumulation)	long-term	B.1-2	KH-P I	bucket flotation	16250	115	48	143.5	a
KIN16B502s13	B	502	debris	short-term	B.1-2	KH-P I	bucket flotation	6200	16	7	9	b
KIN12B488s18	B	488	pyrotechnic	short-term	B.1a	KH-P I	bucket flotation	3500	10	13	6	a
KIN12B727s417	B	727	debris	short-term	B.1a	KH-P I	bucket flotation	3500	510	50*	4	
KIN13B638s60	B	638	pit fill	long-term	B.1a	KH-P I	wash-over technique	6000	46	14	29	b
KIN13B644s67	B	644	pit fill	long-term	B.1a	KH-P I	bucket flotation	16000	114	10	279	b
KIN14B855s4	B	855	layer (accumulation)	long-term	B.1a	KH-P I	wash-over technique	9250	27	4	15	a,b
KIN14B860s15	B	860	surface	short-term	B.1a	KH-P I	wash-over technique	10000	10	8	22	
KIN14B865s17	B	865	layer (accumulation)	long-term	B.1a	KH-P I	wash-over technique	9500	74	14	25	b
KIN14B870s23	B	870	pyrotechnic	short-term	B.1a	KH-P I	wash-over technique	7800	42	35	27	
KIN12B522s96	B	522	pit fill	long-term	B.1a-b	KH-P I	bucket flotation	10000	175	26	706.5	
KIN12B562s158	B	562	pit fill	long-term	B.1a-b	KH-P I	bucket flotation	10000	10	1	5.5	b
KIN12B563s160	B	563	pit fill	long-term	B.1a-b	KH-P I	bucket flotation	1000	10	12	0	
KIN12B520s93	B	520	surface	short-term	B.1b	KH-P I	bucket flotation	10000	21	4	5	a
KIN12B540s130	B	540	pit fill	long-term	B.1b	KH-P I	bucket flotation	10000	10	13	17.5	
KIN13B617s26	B	617	layer (accumulation)	long-term	B.1b	KH-P I	wash-over technique	10000	127	39	140	
KIN14B856s3	B	856	layer (accumulation)	long-term	B.1b	KH-P I	wash-over technique	6500	34	13	10	b
KIN12B534s123	B	534	surface	short-term	B.2	KH-P I	bucket flotation	10000	16	26	25	
KIN13B608s39	B	608	pit fill	long-term	B.2	KH-P I	wash-over technique	10000	57	18	58	b
KIN13B633s45	B	633	pit fill	long-term	B.2	KH-P I	wash-over technique	7500	222	27	706	b
KIN13B636s53	B	636	layer (accumulation)	long-term	B.2	KH-P I	wash-over technique	9000	84	9	453	a,b
KIN13B762s122	B	762	pit fill	long-term	B.2	KH-P I	bucket flotation	14500	92	15	128	
KIN13B789s155	B	789	layer (accumulation)	long-term	B.2	KH-P I	bucket flotation	15000	39	17	59	
KIN14B895s78	B	895	other fill	short-term	B.2	KH-P I	wash-over technique	10000	102	7	27.5	b
KIN15B2082s42	B	2082	pit fill	long-term	B.2	KH-P I	bucket flotation	26500	110	13	77	a,b
KIN13A146s61	A1	146	surface	short-term	A1.1a	KH-P IIA	bucket flotation	10000	130	49	109	
KIN14A131s138	A1	131	debris	short-term	A1.1a	KH-P IIA	bucket flotation	9000	6	0	4	
KIN17A1830s12	A1	1830	pit fill	long-term	A1.1	KH-P IIB	bucket flotation	8000	13	3	123	
KIN18A1974s70	A1	1974	dump	long-term	A1.1c-d	KH-P IIB	machine flotation	20000	280	169	19	
KIN18A1987s73	A1	1987	layer (accumulation)	long-term	A1.1e	KH-P IIB	machine flotation	18000	370	100*	102	
KIN14A1502s44	A1	1502	layer (accumulation)	long-term	A1.1a-b	KH-P IIB	bucket flotation	7150	77	10	609	a
KIN14A1512s48	A1	1512	pyrotechnic	short-term	A1.1b	KH-P IIB	bucket flotation	3800	37	10	3409	
KIN14A1534s101	A1	1534	surface	short-term	A1.1c	KH-P IIB	bucket flotation	10450	240	44	687	b
KIN14A1540s98	A1	1540	pyrotechnic	short-term	A1.1c	KH-P IIB	bucket flotation	650	620	75*	149	
KIN15A1539s77	A1	1539	layer (accumulation)	long-term	A1.1c	KH-P IIB	bucket flotation	8500	78	73	454	
KIN15A1607s11	A1	1607	layer (accumulation)	long-term	A1.1c	KH-P IIB	bucket flotation	7750	440	50*	6	
KIN12A233s261	A2	233	pit fill	long-term	A2.2	KH-P IIB	bucket flotation	2000	10	1	33	
KIN12A233s273	A2	233	pit fill	long-term	A2.2	KH-P IIB	bucket flotation	8000	27	1	259	

SAMPLE	trench	unit	unit type	unit class	level/phase	period	preparation	soil (ml)	LF (ml)	# Char.	# Carp.	notes
KIN12A237s238	A2	237	structure fill	short-term	A2.2	KH-P IIB	bucket flotation	3000	41	26	84.5	
KIN13A939s257	A2	939	pit fill	long-term	A2.2	KH-P IIB	bucket flotation	13000	85	6	584	
KIN13A950s242	A2	950	pit fill	long-term	A2.2	KH-P IIB	bucket flotation	14000	28	9	74.5	
KIN13A967s266	A2	967	layer (accumulation)	long-term	A2.2	KH-P IIB	bucket flotation	11000	100	74	252	
KIN13A972s304	A2	972	pit fill	long-term	A2.2	KH-P IIB	bucket flotation	19000	105	7	99.5	
KIN13A982s293	A2	982	pit fill	long-term	A2.2	KH-P IIB	bucket flotation	16000	70	12	141	
KIN14B803s113	B	803	surface	short-term	B.3a	KH-P IIB	bucket flotation	90	10	3	11	
KIN12B560s156	B	560	layer (accumulation)	long-term	B.3b-4a	KH-P IIB	bucket flotation	nr	29	20	17.5	
KIN15B2109s93	B	2109	layer (accumulation)	long-term	B.3b-4a	KH-P IIB	bucket flotation	16000	295	100*	61	
KIN16B2221s119	B	2221	surface	short-term	B.3b-4a	KH-P IIB	bucket flotation	16500	140	15	1359.5	
KIN15B2113s108	B	2113	pyrotechnic	short-term	B.4	KH-P IIB	bucket flotation	6000	22	9	127	
KIN15B2111s116	B	2111	layer (accumulation)	long-term	B.4a	KH-P IIB	bucket flotation	3000	90	51	21	
KIN12B549s138	B	549	surface	short-term	B.4a-b	KH-P IIB	bucket flotation	nr	140	81	98.5	
KIN16B2181s34	B	2181	layer (accumulation)	long-term	B.4b	KH-P IIB	bucket flotation	7250	32	11	207	
KIN16B2196s59	B	2196	dump	long-term	B.4b-c	KH-P IIB	bucket flotation	17000	70	41	248	
KIN13B767s126	B	767	pyrotechnic	short-term	B.4c	KH-P IIB	bucket flotation	20000	135	26	170	b
KIN14B2018s120	B	2018	surface	short-term	B.4c	KH-P IIB	bucket flotation	nr	80	82	62	
KIN14B2031s133	B	2031	pithos fill	short-term	B.4c	KH-P IIB	bucket flotation	27000	305	22	591	b
KIN14B2032s135_a	B	2032	pyrotechnic	short-term	B.4c	KH-P IIB	bucket flotation	4500	265	129	464	
KIN14B2032s135_b	B	2032	pyrotechnic	short-term	B.4c	KH-P IIB	bucket flotation	4000	52	21	106	b
KIN14B2032s140	B	2032	pyrotechnic	short-term	B.4c	KH-P IIB	bucket flotation	4500	205	10	21	
KIN14B845s132	B	845	pyrotechnic	short-term	B.4c	KH-P IIB	bucket flotation	3150	16	15	124	
KIN15B2091s57	B	2091	pyrotechnic	short-term	B.4c	KH-P IIB	bucket flotation	3000	10	13	62	
KIN15B2098s77	B	2098	pithos fill	short-term	B.4c	KH-P IIB	bucket flotation	20250	52	5	115	
KIN15B2107s86	B	2107	layer (accumulation)	long-term	B.4c	KH-P IIB	bucket flotation	10000	16	2	69	
KIN13D1044s25	D	1044	pit fill	long-term	D.2a	KH-P IIB	bucket flotation	900	8	0	40	
KIN13D1070s71	D	1070	pyrotechnic	short-term	D.2a	KH-P IIB	bucket flotation	12000	65	27	4	
KIN13D1041s23	D	1041	pit fill	long-term	D.2a-b	KH-P IIB	bucket flotation	3000	29	3	919.5	
KIN13A175s117	A1	175	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	10000	220	86	1082	
KIN15A1668s85	A1	1668	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	8000	560	200*	9	
KIN15A1676s93	A1	1676	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	6500	210	156	21.5	
KIN15A1685s131	A1	1685	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	11000	93	83	255	
KIN16A1683s4	A1	1683	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	20750	410	200*	65	
KIN16A1685s52	A1	1685	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	18000	270	200*	116	
KIN16A1689s26	A1	1689	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	17000	205	135	96	
KIN16A1711s67	A1	1711	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	18250	270	121	111.5	
KIN16A1721s55	A1	1721	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	10750	175	136	109	
KIN16A1732s70	A1	1732	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	6200	110	64	33	

SAMPLE	trench	unit	unit type	unit class	level/phase	period	preparation	soil (ml)	LF (ml)	# Char.	# Carp.	notes
KIN16A1745s95	A1	1745	layer (accumulation)	long-term	A1.2a	KH-P III	bucket flotation	13750	300	89	507	
KIN18A1996s91	A1	1996	layer (accumulation)	long-term	A1.2a	KH-P III	machine flotation	28000	440	100*	181.5	
KIN18A3610s123	A1	3610	pyrotechnic	short-term	A1.2a	KH-P III	machine flotation	18000	3319	100*	0	
KIN17A1771s64	A1	1771	layer (accumulation)	long-term	A1.2b	KH-P III	machine flotation	28000	10	7	38	
KIN17A1771s65	A1	1771	layer (accumulation)	long-term	A1.2b	KH-P III	machine flotation	30000	37	5	55.5	
KIN17A1771s66	A1	1771	layer (accumulation)	long-term	A1.2b	KH-P III	machine flotation	10000	8	0	7	
KIN17A1771s67	A1	1771	layer (accumulation)	long-term	A1.2b	KH-P III	machine flotation	20000	16	5	32	
KIN18A1902s4	A1	1902	layer (accumulation)	long-term	A1.2b	KH-P III	machine flotation	18000	125	25	247	b
KIN17A1790s135	A1	1790	layer (accumulation)	long-term	A1.3	KH-P III	machine flotation	20000	45	44	135.5	
KIN17A1893s149	A1	1893	layer (accumulation)	long-term	A1.3	KH-P III	machine flotation	20000	415	68	687.5	
KIN17A1894s157	A1	1894	layer (accumulation)	long-term	A1.3	KH-P III	machine flotation	30000	570	57	1148	
KIN17A1894s158	A1	1894	layer (accumulation)	long-term	A1.3	KH-P III	machine flotation	10000	33	0	487.5	
KIN12A231s258	A2	231	layer (accumulation)	long-term	A2.3	KH-P III	bucket flotation	3500	17	0	50	a
KIN12A231s260	A2	231	layer (accumulation)	long-term	A2.3	KH-P III	bucket flotation	9500	16	12	4	
KIN13B790s152	B	790	layer (accumulation)	long-term	B.5	KH-P III	wash-over technique	10000	37	24	66	
KIN14B899s91	B	899	layer (accumulation)	long-term	B.5b-6a	KH-P III	wash-over technique	10000	115	23	303.5	
KIN13B802s162	B	802	layer (accumulation)	long-term	B.6	KH-P III	wash-over technique	10000	90	17	340	
KIN13B804s167	B	804	layer (accumulation)	long-term	B.6	KH-P III	wash-over technique	10000	107	37	172	
KIN14B2002s105	B	2002	pyrotechnic	short-term	B.6b	KH-P III	wash-over technique	1000	13	4	294.5	
KIN14B2002s106_a	B	2002	pyrotechnic	short-term	B.6b	KH-P III	wash-over technique	10000	77	34	478.5	
KIN14B2002s106_b	B	2002	pyrotechnic	short-term	B.6b	KH-P III	wash-over technique	6000	75	20	523	
KIN13B807s175	B	807	bin fill	long-term	B.7	KH-P III	bucket flotation	14000	10	49	504	
KIN14B807s125	B	807	bin fill	long-term	B.7	KH-P III	wash-over technique	8500	10	49	593	
KIN14B807s38_a	B	807	bin fill	long-term	B.7	KH-P III	wash-over technique	3000	72	22	577	
KIN14B807s38_b	B	807	bin fill	long-term	B.7	KH-P III	wash-over technique	3000	29	11	271	
KIN14B817s33	B	817	debris	short-term	B.7	KH-P III	wash-over technique	9000	59	22	70	
KIN14B876s115	B	876	surface	short-term	B.7	KH-P III	wash-over technique	7500	42	24	112	
KIN15D2379s117	D	2379	layer (accumulation)	long-term	D.3	KH-P III	bucket flotation	15500	185	16	99	b
KIN13D1073s67	D	1073	layer (accumulation)	long-term	D.3a	KH-P III	bucket flotation	2500	8	0	3	
KIN13D1144s185	D	1144	layer (accumulation)	long-term	D.3a	KH-P III	wash-over technique	4800	55	1	240	b
KIN14D1124s4	D	1124	surface	short-term	D.3a	KH-P III	wash-over technique	4500	32	3	73.5	b
KIN14D1149s73	D	1149	surface	short-term	D.3a	KH-P III	wash-over technique	2500	27	6	144.5	
KIN14D1155s20	D	1155	layer (accumulation)	long-term	D.3a	KH-P III	wash-over technique	9500	87	11	254.5	b
KIN14D1109s95	D	1109	surface	short-term	D.3b	KH-P III	wash-over technique	1500	8	0	37	
KIN14D1166s138	D	1166	pyrotechnic	short-term	D.3b	KH-P III	wash-over technique	9000	115	23	52	
KIN14D1166s52_a	D	1166	pyrotechnic	short-term	D.3b	KH-P III	wash-over technique	3600	10	3	18.5	
KIN14D1166s52_b	D	1166	pyrotechnic	short-term	D.3b	KH-P III	wash-over technique	2600	8	0	45	
KIN14D2302s102	D	2302	pyrotechnic	short-term	D.3b	KH-P III	wash-over technique	10000	10	3	33	b

SAMPLE	trench	unit	unit type	unit class	level/phase	period	preparation	soil (ml)	LF (ml)	# Char.	# Carp.	notes
KIN14D2314s140	D	2314	surface	short-term	D.3b	KH-P III	bucket flotation	8000	117	6	101	b
KIN15D2376s140	D	2376	pit fill	long-term	D.3b	KH-P III	bucket flotation	17500	102	3	75.5	b
KIN14D1192s101	D	1192	pyrotechnic	short-term	D.3c	KH-P III	wash-over technique	3000	10	0	359.5	
KIN14D1192s88	D	1192	pyrotechnic	short-term	D.3c	KH-P III	wash-over technique	9000	29	0	931	
KIN15D2385s150	D	2385	surface	short-term	D.3c	KH-P III	bucket flotation	12000	140	9	1219.5	b
KIN15D2313s74	D	2313	pyrotechnic	short-term	D.4a	KH-P III	bucket flotation	7500	75	0	107.5	
KIN15D2348s38	D	2348	pyrotechnic	short-term	D.4a	KH-P III	bucket flotation	20000	40	5	294.5	
KIN16D2416s37	D	2416	fire layer	short-term	D.4a	KH-P III	bucket flotation	11000	230	10	3656.5	
KIN17A1878s165	A1	1878	pit fill	long-term	A1.4	KH-P IV	machine flotation	8000	51	36	202	
KIN12A249s256	A2	249	layer (accumulation)	long-term	A2.4a	KH-P IV	bucket flotation	3000	10	2	0	
KIN12A250s267	A2	250	layer (accumulation)	long-term	A2.4a	KH-P IV	bucket flotation	6000	2	17	136	
KIN12A281s300	A2	281	layer (accumulation)	long-term	A2.4a	KH-P IV	bucket flotation	2000	10	3	60.5	
KIN12A291s313	A2	291	surface	short-term	A2.4a	KH-P IV	bucket flotation	12000	13	15	105.5	
KIN18A1379s31	A2	1379	pyrotechnic	short-term	A2.4a	KH-P IV	machine flotation	27000	105	81	459.5	
KIN18A1377s3	A2	1377	layer (accumulation)	long-term	A2.4b	KH-P IV	machine flotation	31000	180	124	182	
KIN18A1397s36	A2	1397	pyrotechnic	short-term	A2.4b	KH-P IV	machine flotation	10000	28	31	46	
KIN15C2520s11	C3-E	2520	pit fill	long-term	C3E.2	KH-P IV	bucket flotation	46000	200	49	205	b
KIN16C2659s47	C3-E	2659	surface	short-term	C3E.2	KH-P IV	bucket flotation	4250	10	14	10	
KIN16C2672s9999	C3-E	2672	layer (accumulation)	long-term	C3E.2	KH-P IV	bucket flotation	3250	10	9	12	
KIN17C2805s16	C3-E	2805	pit fill	long-term	C3E.2	KH-P IV	machine flotation	14500	24	37	29	
KIN17C2814s27	C3-E	2814	pit fill	long-term	C3E.2	KH-P IV	machine flotation	18000	16	19	42	
KIN17C2825s38	C3-E	2825	pit fill	long-term	C3E.2	KH-P IV	machine flotation	8000	29	70	27	
KIN17C2830s40	C3-E	2830	pit fill	long-term	C3E.2	KH-P IV	machine flotation	13000	19	27	67	
KIN17C2853s81	C3-E	2853	pit fill	long-term	C3E.2	KH-P IV	machine flotation	17000	13	6	50	
KIN17C642s30	C3-E	642	surface	short-term	C3E.2	KH-P IV	machine flotation	9000	44	50*	5	
KIN17C665s63	C3-E	665	pit fill	long-term	C3E.2	KH-P IV	machine flotation	15000	14	10	136.5	
KIN18C2870s13	C3-E	2870	pit fill	long-term	C3E.2	KH-P IV	machine flotation	39000	40	32	116.5	
KIN18C2870s15	C3-E	2870	pit fill	long-term	C3E.2	KH-P IV	machine flotation	38000	45	36	123	
KIN18C2874s5	C3-E	2874	surface	short-term	C3E.2	KH-P IV	machine flotation	18000	155	30	101	b
KIN17C2683s13	C3-W	2683	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	15000	16	10	62	
KIN17C2811s32	C3-W	2811	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	22000	19	28	63	
KIN17C2812s22	C3-W	2812	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	28000	65	145	203	c
KIN17C2812s39	C3-W	2812	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	14000	19	27	75	
KIN17C2833s47	C3-W	2833	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	25500	55	68	144	
KIN17C2834s51	C3-W	2834	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	25000	60	67	357	
KIN17C2837s56	C3-W	2837	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	21500	205	156	1754.5	
KIN17C2838s59	C3-W	2838	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	nr	125	138	0	c
KIN17C2838s61	C3-W	2838	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	18000	95	83	994	

SAMPLE	trench	unit	unit type	unit class	level/phase	period	preparation	soil (ml)	LF (ml)	# Char.	# Carp.	notes
KIN17C2841s67	C3-W	2841	layer (accumulation)	long-term	C3W.3	KH-P IV	machine flotation	22000	70	41	76	b
KIN14A153s32	Aw	153	layer (accumulation)	long-term	Aw.6	KH-P VA	machine flotation	22150	162	85	354	
KIN17A1402s4	Aw	1402	layer (accumulation)	long-term	Aw.7	KH-P VA	machine flotation	26500	16	22	51	
KIN17A1406s17	Aw	1406	layer (accumulation)	long-term	Aw.7	KH-P VA	machine flotation	20000	90	53	125	a
KIN17A1410s34	Aw	1410	layer (accumulation)	long-term	Aw.7	KH-P VA	machine flotation	12000	13	26	35	
KIN17A164s26	Aw	164	layer (accumulation)	long-term	Aw.7	KH-P VA	machine flotation	21000	35	23	170	
KIN17A164s55	Aw	164	layer (accumulation)	long-term	Aw.7	KH-P VA	machine flotation	21000	125	106	71	
KIN15C2524s15	C3-E	2524	layer (accumulation)	long-term	C3E.3	KH-P VA	bucket flotation	15000	55	20	84	
KIN18C2524s23	C3-E	2524	layer (accumulation)	long-term	C3E.3	KH-P VA	machine flotation	24000	63	37	60	
KIN17C2845s73	C3-W	2845	layer (accumulation)	long-term	C3W.4	KH-P VA	machine flotation	16000	47	48	83	
KIN17C2851s76	C3-W	2851	layer (accumulation)	long-term	C3W.4	KH-P VA	machine flotation	18000	32	38	122	
KIN17C2536sNR	C3-E	2536	layer (accumulation)	long-term	C3E.4	KH-P VB	machine flotation	4000	16	24	10	
KIN18C2526s28	C3-E	2526	layer (accumulation)	long-term	C3E.4	KH-P VB	machine flotation	10000	70	62	51	
KIN18C2536s29	C3-E	2536	layer (accumulation)	long-term	C3E.4	KH-P VB	machine flotation	30000	275	100*	98	
KIN18C2890s30	C3-E	2890	fire layer	short-term	C3E.4	KH-P VB	machine flotation	18000	150	100*	62	
KIN18C2892s31	C3-E	2892	fire layer	short-term	C3E.4	KH-P VB	machine flotation	10000	670	50*	31.5	
KIN18C2897s35	C3-E	2897	layer (accumulation)	long-term	C3E.4	KH-P VB	machine flotation	30000	52	45	168	
KIN18C2898s36	C3-E	2898	pit fill	long-term	C3E.4	KH-P VB	machine flotation	20000	21	32	59	
KIN18C3402s42	C3-E	3402	layer (accumulation)	long-term	C3E.5	KH-P VB	machine flotation	32000	140	78	246	
KIN18C3403s43	C3-E	3403	layer (accumulation)	long-term	C3E.5	KH-P VB	machine flotation	49000	340	100*	204	
KIN18C3410s44	C3-E	3410	pit fill	long-term	C3E.6	KH-P VI	machine flotation	10000	45	29	52	
KIN18C3411s49	C3-E	3411	layer (accumulation)	long-term	C3E.6	KH-P VI	wash-over technique	16000	225	62	80	

APPENDIX 4

Catalogue of the anthracological flora from Niğde-Kınık Höyük

In this appendix, for each taxon identified in the wood charcoal record (Chapter 5), I am providing: (*i*) a brief description of the wood anatomy; (*ii*) a discussion of the criteria on which the identification is based; (*iii*) a list of the candidate taxa in the Turkish flora; and (*iv*) the attestations in the Niğde-Kınık Höyük dataset (ubiquity and count). In ubiquity, samples without wood charcoal are not included. Taxonomy follows the Flora of Turkey (Davis 1965-1985). Abbreviations used in plates: TRs= Transverse Section; TAs= Tangential Section; RAs= Radial Section.

CUPRESSACEAE ______ 687
Juniperus spp.

PINACEAE ______ 687
Abies sp.
Cedrus sp.
Pinus sp.
Pinus brutia-Type
Pinus nigra-Type

ACERACEAE ______ 690
Acer spp.

ANACARDIACEAE ______ 690
Pistacia sp.

ASTERACEAE ______ 691
Asteraceae-Type

BUXACEAE ______ 692
Buxus sempervirens

CHENOPODIACEAE______ 692
Chenopodiaceae s.l.

CORYLACEAE______ 693
Ostrya carpinifolia

ELEAGNACEAE 693
Elaeagnus angustifolia
Hippophae rhamnoides

EUPHORBIACEAE 694
Euphorbia sp.

FAGACEAE 695
Quercus spp. deciduous

JUGLANDACEAE 696
Juglans regia

MONOCOTYLEDONEAE 696
Monocotyledoneae s.l.

MORACEAE 697
Ficus carica (tentative)
Morus sp.

OLEACEAE 698
Fraxinus sp.
Fraxinus angustifolia/ornus

RHAMNACEAE 699
Rhamnus sp.

ROSACEAE 699
Amygdalus/Prunus
Amygdalus-Type
Prunus-Type
Maloideae

SALICACEAE 701
Salicaceae s.l.

TAMARICACEAE 702
Tamarix sp.

ULMACEAE 702
Ulmaceae s.l.
Celtis sp.
Ulmus sp.

VITACEAE 703
Vitis vinifera

CUPRESSACEAE

- *Juniperus* spp. – junipers

Evergreen shrubs or trees. The following species are described in the Flora of Turkey: *Juniperus drupacea*, *J. communis*, *J. oblonga*, *J. oxycedrus*, *J. phoenicia*, *J. foetidissima*, *J. sabina*, *J. excelsa*.

Wood anatomy: the transition from the early to late wood is gradual. False rings might be present; resin canals are absent. Rays are uniseriate, homocellular, generally short (1 to 5 cells), higher only in some species (up to 20 cells). Horizontal ray cells are smooth, while tangential walls might be nodular.

Identification notes: *Juniperus* charcoal can be identified based on the lack of resin canals and the presence of homocellular low rays. Besides differences in rays' heigh, a confusion with *Abies* spp. can be further excluded by the presence in *Juniperus* smooth horizontal walls in rays. Confusion with *Cupressus* is reasonably excluded considering the dominance of low rays. Identification to the species level based on wood anatomy is problematic, and here not conducted.

Bibliography: Schweingruber 1990: 137-143.

Plate 1 – a, b, c

Ubiquity: KH-P IIB, 2/38; KH-P III, 5/47; KH-P IV, 17/31; KH-P VA, 8/10; KH-PVB, 7/9; KH-P VI, 2/2

Count: KH-P IIB, 5/1405; KH-P III, 6/2328; KH-P IV, 44/1461; KH-P VA, 26/458; KH-PVB, 42/591; KH-P VI, 11/92

PINACEAE

- ***Abies* sp.** – fir

Conical evergreen trees. In the Anatolian flora, two *Abies* species are present: *A. cilicica* occurring in S. Anatolia and *A. nordmanniana* occurring in the north. On a phytogeographic basis the *Abies* charcoal fragments from N-KH are very reasonably attributed to *A. cilicica*.

Wood anatomy: resin canals are absent. Rays are uniseriate and homocellular. Horizontal ray cells are smooth to dentate, tangential walls are with nodular chains. Average ray height is from (2)15 to 20(40) cells. Cross-field are with taxodioid (early wood) or piceoid (late wood) pits.

Identification notes: *Abies* charcoal can be identified based on the lack of resin canals and the presence of homocellular and very high rays. In addition to significant difference in ray height, *Juniperus* spp. can be further excluded by the presence in *Abies* of rays with nodular transversal and tangential walls.

Species in the genus cannot be distinguished on the basis of wood anatomy.

Bibliography: Schweingruber 1990: 108-109.

Plate 1 – d, e, f

Ubiquity: KH-P IIB, 1/38; KH-P III, 3/47; KH-P IV, 1/31; KH-P VA, 1/10; KH-PVB, 1/9

Count: KH-P IIB, 1/1405; KH-P III, 3/2328; KH-P IV, 1/1461; KH-P VA, 2/458; KH-PVB, 4/591

- ***Cedrus* sp.** – cedar

Tall evergreen tree. *Cedrus libani* is the only species in this genus described from Turkey.

Wood anatomy: resin canals are present only in traumatic form. Rays are uniseriate or rarely biseriate, heterocellular. Rays are bordered by a single row of ray tracheids. Ray parenchyma cell walls are thick, while ray tracheids are thin walled. Axial tracheid pits with very distinctive scalloped tori. Average ray height if from (3)10 to 25(35) cells.

Identification notes: *Cedrus* charcoal can be easily identified by the presence of tracheid pits with scalloped tori (fringed margins). Species in the genus are not distinguishable based on wood anatomy.

Bibliography: Schweingruber 1990: 110-111.

Plate 1 – g, h

Ubiquity: KH-P III, 1/47; KH-P IV, 3/31

Count: KH-P III, 1/2328; KH-P IV, 3/1461

- ***Pinus* spp.** – pine

Evergreen trees. The following species are described in the Flora of Turkey: *Pinus sylvestris, P. nigra, P. brutia, P. halepensis, P. pinea.*

Wood anatomy: resin canals are present, frequent and with thin-walled epithelial cells. Rays are uniseriate (rarely biseriate), heterocellular. Cross-fields are with pinoid or fenestriform pits (see below). Ray tracheids are with dentate or smooth walls (see below).

Identification notes: to *Pinus* spp. are attributed charcoal fragments with resin canals bordered by thin-walled epithelial cells and having heterocellular rays. In the specimens identified as *Pinus* spp., it is impossible to clearly observe the ray cross-field, thus hampering to a more precise identification (see below).

Bibliography: Schweingruber 1990: 118-133.

Ubiquity: KH-P IIB, 1/38; KH-P IV, 1/31

Count: KH-P IIB, 4/1405; KH-P IV, 1/1461

- ***Pinus brutia*-Type** – Turkish or Aleppo pine type

Evergreen trees. *P. brutia* and *P. halepensis* are the two species distributed in Anatolia and attributed to this type.

Wood anatomy: general characteristics of *Pinus*. Cross-field with 1 to 3(4) pinoid pits. Ray tracheids generally with marked dentate walls.

Identification notes: the presence of pinoid pits is characteristic of *P. pinea, P. pinaster, P. leucodermis, P. heldreichii, P. brutia, P. halepensis. P. pinea* can be excluded because of the presence in our specimens of ray tracheids with dentate walls. In *P. pinaster, P. leucodermis, P. heldreichii* ray tracheids are smooth or only slightly dentated. With *P. brutia* type it is thus referred to *P. brutia* and *P. halepensis*. These two species cannot be distinguished on the basis of wood anatomy.

Bibliography: Schweingruber 1990: 120-121.

Plate 2 – a, b

Ubiquity: KH-P I, 2/25; KH-P IIB, 5/38; KH-P III, 1/47; KH-P IV, 2/31; KH-PVB, 1/9

Count: KH-P I, 8/444; KH-P IIB, 14/1405; KH-P III, 1/2328; KH-P IV, 2/1461; KH-PVB, 1/591; KH-P VI, 0/92

- ***Pinus nigra*-Type** – black or Scot pine

Evergreen trees. *Pinus nigra* and *P. sylvestris* are the two species distributed in Anatolia and attributed to this type.

Wood anatomy: general characteristics of *Pinus*. Cross-field with one (rarely two) fenestriform pits. Ray tracheids with dentate walls.

Identification notes: the presence of fenestriform pits is characteristic of *P. nigra, P. sylvestris, P. mugo, P. uncinata, P. cembra, P. peuce, P. strobus*. The presence of dentate ray tracheid walls allows to exclude *P. cembra, P. peuce, P. strobus*. With *P. nigra* type we thus refer to *P. nigra, P. sylvestris, P. mugo, P. uncina*ta. These four species cannot be distinguished on the basis of wood anatomy.

Bibliography: Schweingruber 1990: 128-129.

Plate 2 – c, d

Ubiquity: KH-P I, 7/25; KH-P IIA, 1/1; KH-P IIB, 9/38; KH-P III, 7/47; KH-P IV, 16/31; KH-P VA, 8/10; KH-PVB, 5/9; KH-P VI, 1/2

Count: KH-P I, 20/444; KH-P IIA, 1/49; KH-P IIB, 19/1405; KH-P III, 9/2328; KH-P IV, 51/1461; KH-P VA, 28/458; KH-PVB, 18/591; KH-P VI, 2/92

ACERACEAE

- ***Acer* spp.** – maple

Shrubs or small trees. The following species are described in the Flora of Turkey: *Acer negundo, A. tataricum, A. sempervirens, A. cappadocicum, A. platanoides, A. campestre, A. divergens, A. hyrcanum, A. trautvetteri, A. pseudoplatanus, A. monspessulanum.*

Wood anatomy: wood with diffuse porosity, generally with low density of pores, distributed solitary or in short radial files. Rays are 3- to 6- seriate, homogeneous. Abundant spiral thickenings are present in the vessels. Perforation plates are simple.

Identification notes: the distinction to the species level based on wood anatomy is problematic. Variability on ray width suggests the presence of more than one species, which distinction is not recorded due to their frequent overlap. Confusion with *Prunus*-Type is excluded based on ray anatomy (homogeneous) and pores distribution.

Bibliography: Schweingruber 1990: 174-184.

Plate 2 – e, f

Ubiquity: KH-P I, 3/25; KH-P IIB, 1/38; KH-P III, 4/47; KH-P IV, 6/31; KH-P VA, 3/10; KH-P VI, 1/2

Count: KH-P I, 4/444; KH-P IIB, 1/1405; KH-P III, 7/2328; KH-P IV, 6/1461; KH-P VA, 11/458; KH-P VI,1 /92

ANACARDIACEAE

- ***Pistacia* sp.** – pistachio

Trees or shrubs. The following species are described in the Flora of Turkey: *Pistacia lentiscus, P. atlantica, P. eurycarpa, P. vera, P. khinjuk, P. terebinthus.*

Wood anatomy: wood with ring to semi-ring porosity. Earlywood pores are distributed with low density; latewood pores are generally in short radial files or dendritic pattern. Conspicuous tyloses are present.

Rays are uni- to 5-seriate, heterogeneous. Large vessel-ray pits are present. Copious spiral thickenings are present in the vessels. Perforation plates are simple. Sporadic resin canals in rays are at times noted.

Identification notes: the distinction of *Pistacia* species based on wood anatomy is problematic, thus here not aimed.

Bibliography: Schweingruber 1990: 188-191.

Plate 2 – g, h

Ubiquity: KH-P I, 1/25; KH-P III, 6/47; KH-P IV, 2/31; KH-P VA, 5/10; KH-PVB, 5/9

Count: KH-P I, 1/444; KH-P III, 8/2328; KH-P IV, 3/1461; KH-P VA, 11/458; KH-PVB, 7/591

ASTERACEAE (Compositae)

- **Asteraceae-Type** – aster family type

Woody members of the Asteraceae family. To further narrow the identification, it would be necessary a detailed study of Anatolian Asteraceae wood anatomy. Among others, candidate genera are *Artemisia* spp., *Senecio* spp., *Anthemis* spp., *Tanacetum* spp., *Ptilostemon* spp., *Staehelina* spp.

Wood anatomy: small caliber charcoals. The porosity is diffuse, with pores having a circular outline and arranged either in radial or loose tangential discontinuous bands. Rays are heterogeneous, generally 2 to 3-seriate and composed by thin-walled cells. Perforation plates are simple. Spirals are not observable in the analyzed specimens.

Identification notes: the fragments included in this type are consistent with the anatomy described for the Asteraceae family (e.g., Carlquist 1966), however, lacking detailed literature on wood anatomy of Turkish small shrubs and woody herbs, and being those taxa poorly covered in the available reference material, I have taken a more cautious approach in considering the identification as type rather than family. Some of the fragments attributed to this type are most likely to be identified as *Artemisia* sp.

Bibliography: Schweingruber 1990: 290-319.

Plate 3 – a

Ubiquity: KH-P I, 6/25; KH-P IIB, 2/38; KH-P III, 5/47; KH-P IV, 6/31; KH-P VA, 2/10

Count: KH-P I, 22/444; KH-P IIB, 8/1405; KH-P III, 13/2328; KH-P IV, 12/1461; KH-P VA, 3/458

BUXACEAE

- ***Buxus sempervirens*** – boxwood

Small tree. *Buxus sempervirens* is the only native species of the genus *Buxus* in the Turkish Flora.

Wood anatomy: wood with diffuse porosity, pores are very small, solitary distributed. Rays are heterogeneous, uni- to 3-seriate. Vessels with scalariform perforation plates, with 5 to 10 bars in each perforation.

Identification notes: other species of *Buxus* (e.g., *B. balearica*) are excluded on a purely phytogeographic basis

Bibliography: Schweingruber 1990: 228-229.

Plate 3 – b, c, d

Ubiquity: KH-P III, 1/47

Count: KH-P III, 2/2328

CHENOPODIACEAE

- **Chenopodiaceae s.l.** – goosefoot family

Various Chenopodiaceae have a shrub habit, including: *Atriplex* spp., *Halimione* spp., *Camphorosma* spp., *Kalidiopsis* spp., *Arthrocnemum* spp., *Suaeda* spp., *Noaea* spp. In current taxonomy, chenopodiaceae have been reclassified in the Amarantaceae family.

Wood anatomy: wood with included phloem, pores to the inside of the phloem are organized in groups. Rays are absent/not visible.

Identification notes: an anatomic study of the Turkish Chenopodiaceae is necessary in order to allow an identification of these specimens to the genus level. These taxa are also poorly covered in the available reference material.

Bibliography: Schweingruber 1990: 228-229.

Plate 3 – e,f

Ubiquity: KH-P I, 4/25; KH-P IIB, 1/38; KH-P III, 11/47; KH-P IV, 2/31; KH-P VA, 1/10

Count: KH-P I, 5/444; KH-P IIB, 1/1405; KH-P III, 14/2328; KH-P IV, 2/1461; KH-P VA, 1/458

CORYLACEAE

- ***Ostrya carpinifolia*** – European hop-hornbeam

Deciduous trees or rarely shrubs. In current taxonomy, the genus Ostrya has been reassigned to the Betulaceae family.

Wood anatomy: diffuse porosity. Pores in radial files. Apotracheal parenchyma in diffuse, short, tangential bands. Rays are uni- to 3-seriate, heterogeneous. Simple perforation plates, spiral thickenings are present.

Identification notes: confusion with *Carpinus betulus* is excluded based on the lack of aggregate rays. The identification to the species level is based on phytogeographic assumptions.

Bibliography: Schweingruber 1990: 328-329.

Plate 3 – g, h

Ubiquity: KH-P IIB, 1/38; KH-P III, 2/47

Count: KH-P IIB, 3/1405; KH-P III, 3/2328

ELEAGNACEAE

- ***Elaeagnus angustifolia*** – Russian olive

Tree producing edible fruit. *E. angustifolia* is the only species of the genus *Elaeagnus* in the Anatolian flora.

Wood anatomy: wood with semi-ring porosity. The largest vessels are not at the immediate beginning of the growth ring. The early wood is composed by a large band of densely arranged large pores. In large growth rings, bands of isolated large pores are often alternated to smaller ones. Late wood pores are isolated. Rays are distended at the growth ring boundary. Rays homogeneous, 3- to 10-seriate, less often uni- and bi-seriate. Vessels are with simple perforation plates. Latewood vessels are with fine spiral thickenings. Inter-vessel pits are small and alternate. Vessel-ray pits are similar in shape and size to intravascular pits.

Identification notes: distinction from *Hippophae*, based on ray anatomy (significantly larger rays in *Elaeagnus*), is not problematic. *Elaeagnus* charcoal fragments from N-KH are generally characterized by large growth rings, often the entire ring is not visible. If the end/beginning of the ring is not observable, the specimens are identified as cf. *Elaeagnus*. The identification at the species level is based on phytogeographic considerations.

Bibliography: Schweingruber 1990: 350-351.

Plate 4 – a, b

Ubiquity: KH-P I, 10/25; KH-P IIB, 12/38; KH-P III, 7/47

Count: KH-P I, 15/444; KH-P IIB, 36/1405; KH-P III, 15/2328

- **Hippophae rhamnoides** – seaberry

Bushes or small trees. *H. rhamnoides* is the only species of the genus *Hippophae* in the Anatolian flora.

Wood anatomy: wood with semi-ring porosity. Largest vessels are not at the immediate beginning of the growth ring. Latewood pores are solitary. Rays are uni- or bi-seriate (rarely 3-seriate), generally heterogenous. Vessels are with simple perforation plates and fine spiral thickenings.

Identification notes: *Hippophae* is easily distinguishable from the other identified member of the Elaeagnaceae family (*Elaeagnus angustifolia*) on the basis of differences in ray anatomy (in *Hippophae* narrower and heterogeneous). The identification to the species level is based on phytogeographic considerations.

Bibliography: Schweingruber 1990: 352-353.

Plate 4 – c

Ubiquity: KH-P III, 8/47; KH-P IV, 1/31

Count: KH-P III, 41/2328; KH-P IV, 2/1461

EUPHORBIACEAE

- ***Euphorbia* sp.** – spurges

The genus *Euphorbia* includes subshrubs. A detailed study of Anatolian spurges wood anatomy is necessary in order to further narrow the identification.

Wood anatomy: diffuse porosity, in the transversal section the pores are often poorly differentiated from the surrounding fibers. In the specimen available only uniseriate rays are visible, composed by cells with oval section in the tangential plane. Rays are heterogeneous. Vessels are with simple perforation plates. Latex tubes are not observed.

Identification notes: a single charcoal fragment is attributable to this taxon. The specimen closely recalls *Euphorbia mellifera* described by Schweingruber (1990), which however is not native in western Asia. Further research is necessary, considering the large number of *Euphorbia* species present in central Anatolia and the lack of detailed anatomic studies.

Bibliography: Schweingruber 1990: 388-395.

Plate 4 – d

Ubiquity: KH-P I, 1/25

Count: KH-P I, 1/444

FAGACEAE

- ***Quercus* spp. deciduous** – deciduous oaks

The following oaks species are described in the Flora of Turkey: *Quercus libani, Q. trojana, Q. cerris, Q. brantii, Q. ithaburensis, Q. pontica, Q. infectoria, Q. robur, Q. hartwissiana, Q. macranthera, Q. pubescens, Q. virgiliana, Q. frainetto, Q. vulcanica, Q. petraea.*

Wood anatomy: ring porous wood, with large earlywood pores. Latewood pores are in a dendritic pattern, especially in wide growth rings. Rays are uni- and multi-seriate (up to 1 mm wide and 5 mm high), homogeneous. Vessels are with simple perforation plates.

Identification notes: all *Quercus* charcoal fragments analyzed are ring porous, hence excluding the presence of evergreen oaks. Based on the morphology of latewood pores both the subgenera *Quercus* (sez. *robur*) and *Cerris* (sez. *cerris*) are identified (see Schweingruber 1990 for identification criteria). The distinction was not quantified, being possible only on a small fraction of the material analyzed in this study.

Bibliography: Schweingruber 1990: 400-409.

Plate 4 – e

Ubiquity: KH-P I, 17/25; KH-P IIA, 1/1; KH-P IIB, 33/38; KH-P III, 45/47; KH-P IV, 31/31; KH-P VA, 10/10; KH-P VB, 8/9; KH-P VI, 2/2

Count: KH-P I, 101/444; KH-P IIA, 15/49; KH-P IIB, 620/1405; KH-P III, 1324/2328; KH-P IV, 654/1461; KH-P VA, 256/458; KH-P VB, 255/591; KH-P VI, 58/92

JUGLANDACEAE

- ***Juglans regia*** – walnut

Cultivated trees producing edible fruits.

Wood anatomy: wood with diffuse porosity. Pores are large, distributed solitary or in short radially oriented groups. Parenchyma is apotracheal, diffuse and in short uniseriate tangential bands. Rays are bi- to 4-seriate, homogeneous. Vessels are with simple perforation plates.

Identification notes: a confusion with *Pterocarya* is excluded based on ray anatomy (larger rays). The identification to the species level is based on phytogeographic considerations.

Bibliography: Schweingruber 1990: 400-409.

Plate 4 – f

Ubiquity: KH-P I, 1/25; KH-P IIB, 2/38; KH-P III, 2/47

Count: KH-P I, 1/444; KH-P IIB, 9/1405; KH-P III, 3/2328

MONOCOTYLEDONEAE

- **Monocotyledoneae s.l.** – monocots

Monocot culm fragments.

Wood anatomy: presence of vascular bundles surrounded by sclerenchyma sheath cells.

Identification notes: the fragments attributed to this type are consistent with an identification to the Poaceae family, including a round cross-section (which allows to exclude several Cyperaceae). Lacking an in-deep anatomic study of Anatolian monocots, I cautiously avoided to identify these specimens to the family or genus level.

Bibliography: Schweingruber 1990: 155-173.

Plate 4 – g, h

Ubiquity: KH-P I, 1/25; KH-P IIB, 10/38; KH-P III, 8/47; KH-P IV, 3/31; KH-P VA, 3/10; KH-P VB, 5/9

Count: KH-P I, 1/444; KH-P IIB, 14/1405; KH-P III, 11/2328; KH-P IV, 3/1461; KH-P VA, 4/458; KH-P VB, 20/591

MORACEAE

- **Cf.** ***Ficus carica*** – common fig (tentative)

Cultivated trees producing edible fruits.

Wood anatomy: wood with diffuse porosity. Large pores (up to 100 micron) generally arranged in short radial groups. Presence of abundant vasicentric paratracheal parenchyma. Rays are (2)3-6 seriate, heterogeneous. Perforation plates are simple. Vessels with spiral thickenings absent.

Identification notes: single charcoal fragment (sample KIN15D2379s117_b). The identification is unsure because of the lack of clearly visible tangential bands of paratracheal parenchyma. A confusion with *Juglans* is excluded on the basis of ray anatomy. Confusion with *Morus* is excluded because of the diffuse porosity in the specimen. This identification is to be considered tentative.

Bibliography: Schweingruber 1990: 550-551.

Ubiquity: KH-P III, 1/47

Count: KH-P III, 1/2328

- ***Morus*** **sp.** – mulberry

Cultivated trees of economic importance.

Wood anatomy: ring porous wood, with large pores in the earlywood. Vessels are generally in small clusters, often arranged in radial groups. Frequent tyloses are present. Axial parenchyma is scanty paratracheal to vasicentric. Rays are 4- to 10-seriate, procumbent with one row of upright or square marginal cells. Vessels are with simple perforation plates.

Identification notes: the distinction from *Ficus* is straightforward, based on parenchyma distribution and porosity. The distinction between *Morus nigra* and *M. alba* based on the wood anatomy is not possible.

Bibliography: Schweingruber 1990: 552-553.

Plate 5 – a, b

Ubiquity: KH-P I, 2/25

Count: KH-P I, 5/444

OLEACEAE

- ***Fraxinus* spp.**– ash

Deciduous tree. 4 species are described in the Flora of Turkey: *F. angustifolia*, *F. excelsior*, *F. ornus*, *F. pallisae*.

Wood anatomy: ring porous wood. Latewood pores are solitary or in radially oriented small groups (mostly of 2). Vasicentric paratracheal parenchyma is present. Vessels are with simple perforation plates. Rays are uni- to 3-seriate, homogeneous.

Identification notes: *Fraxinus* species are characterized by a very similar wood anatomy. In well-preserved specimens a distinction between *Fraxinus excelsior* and *F. angustifolia/ornus* can be aimed based on the presence of marginal (or seemingly marginal) bands of apotracheal parenchyma, which are more abundantly found in *F. angustifolia/ornus* (Schweingruber 1990). Specimens with narrow growth rings, in which the latewood is not fully developed and specimens in which the late wood is not observable are attributed to *Fraxinus* spp.

Bibliography: Schweingruber 1990: 565-567.

Ubiquity: KH-P I, 1/25; KH-P IV, 2/31; KH-P VA, 2/10; KH-P VB, 1/9

Count: KH-P I, 1/444; KH-P IV, 2/1461; KH-P VA, 4/458; KH-P VB, 1/591

- ***Fraxinus angustifolia/ornus*** – narrow leafed or manna ash

Tree of possible economic importance for the extraction of an edible sugary sap (manna).

Wood anatomy: general characteristics of *Fraxinus* sp. Identification is based on the presence of apotracheal marginal and pseudo-marginal tangential bands of parenchyma in the latewood.

Identification notes: See consideration under *Fraxinus* spp. Based on the wood anatomy, the distinction between *Fraxinus angustifolia* and *F. ornus* is not possible.

Bibliography: Schweingruber 1990: 565-567.

Plate 5 – c

Ubiquity: KH-P I, 2/25; KH-P IIA, 1/1; KH-P IIB, 5/38; KH-P III, 2/47; KH-P IV, 1/31

Count: KH-P I, 4/444; KH-P IIA, 11/45; KH-P IIB, 30/1405; KH-P III, 27/2328; KH-P IV, 1/1461

RHAMNACEAE

- ***Rhamnus* sp.** – buckthorn

Deciduous or evergreen, thorny or unarmed trees or shrubs. 23 species of *Rhamnus* are described in the Flora of Turkey.

Wood anatomy: wood with diffuse to semi-ring porosity. Pores are associated to parenchyma, forming dendritic bands. Perforations plates are simple. Rays are heterogeneous, uni- to tri-seriate.

Identification notes: species within the genus are not distinguishable based on the wood anatomy.

Bibliography: Schweingruber 1990: 609-611.

Plate 5 – d

Ubiquity: KH-P I, 1/25; KH-P III,3 /47

Count: KH-P I, 1/444; KH-P III, 4/2328

ROSACEAE

- ***Amygdalus/Prunus*** – almonds/plums

See species listed for *Amygdalus*-type and *Prunus*-type.

Wood anatomy: wood having diffuse, semi-ring, or ring porosity (see below). Pores are generally in groups. Rays are uni- and multi-seriate (see below), generally slightly heterogeneous. Perforation plates are simple. Abundant and thick spiral thickenings are present.

Identification notes: it is not always possible to distinguish between *Amygdalus*-type and *Prunus*-type (see below for identification criteria). Intermediate forms between the two types (e.g., having semi-ring porosity), or specimens in which the type-diagnostic characters are not fully observable (e.g., whole ring not preserved) are attributed to *Prunus*/*Amygdalus*.

Ubiquity: KH-P I, 6/25; KH-P IIB, 2/38; KH-P III, 8/47; KH-P IV, 9/31; KH-P VA, 3/10; KH-P VB, 2/9; KH-P VI, 1/2

Count: KH-P I, 18/444; KH-P IIB, 2/1405; KH-P III, 9/2328; KH-P IV, 13/1461; KH-P VA, 6/458; KH-P VB, 2/591; KH-P VI, 4/92

- ***Amygdalus*-Type** – almond type

Tree and shrubs, among others: *Prunus persica, P. armeniaca, P. dulcis, P. webbii, P. korshinsky, P.*

orientalis. In this type are included taxa of economic importance.

Wood anatomy: general characteristics of *Amygdalus*/*Prunus*. Ring porosity and medium/large rays (generally 3-8 seriate).

Identification notes: *Amygdalus*-Type is distinguished from *Prunus*-Type on the basis of the presence of ring-porosity and medium to large rays.

Plate 5 – e

Bibliography: Schweingruber 1990: 630-643.

Ubiquity: KH-P I, 11/25; KH-P IIB, 2/38; KH-P III, 5/47; KH-P IV, 7/31; KH-P VA, 2/10; KH-P VI, 1/2

Count: KH-P I, 88/444; KH-P IIB, 74/1405; KH-P III, 14/2328; KH-P IV, 14/1461; KH-P VA, 3/458; KH-P VI, 1/92

- ***Prunus*-Type** – plums type

Tree and shrubs, among others: *Prunus avium, P. cerasus, P. divaricata, P. domestica, P. mahaleb, P. microcarpa, P. padus, P. prostata, P. spinosa*. In this type are included taxa of economic importance.

Wood anatomy: general characteristics of *Amygdalus*/*Prunus*. Diffuse to semi-ring porosity, pores generally in radially oriented groups. Rays are 1-3 or 3-5 seriate.

Identification notes: *Prunus*-Type is distinguished from *Amygdalus*-Type based on the presence of diffuse porosity and narrow to medium rays.

Bibliography: Schweingruber 1990: 630-643.

Plate 5 – f

Ubiquity: KH-P I, 1/25; KH-P IIA, 1/1; KH-P IIB, 5/38; KH-P III, 13/47; KH-P VA, 1/10; KH-P VB, 2/9

Count: KH-P I, 1/444; KH-P IIA, 3/49; KH-P IIB, 12/1405; KH-P III, 30/2328; KH-P VA, 1/458; KH-P VB, 3/591

- **Maloideae** – apple subfamily

Tree and shrubs, among others: *Amelanchier* spp., *Cotoneaster* spp., *Crataegus* spp., *Cydonia* spp., *Malus* spp., *Mespilus* spp., *Pyracantha* spp., *Pyrus* spp., *Sorbus* spp. In this type are included taxa of economic importance.

Wood anatomy: wood with diffuse porosity. Pores are densely distributed, small, and generally solitary. Rays are bi- to 3-seriate, homogeneous. Perforation plates are simple. Fine spiral thickenings are often present.

Identification notes: Maloideae is a subfamily of the Rosaceae. The specimens from N-KH are frequently characterized by the presence of fine spirals. Maloideae are distinguished from *Prunus*-type on the basis of distribution of pores (clusters and groups are present in *Prunus*-type), ray (generally larger and heterogeneous in *Prunus*-Type), and vessel anatomy (spirals more copious and significantly thicker in *Prunus*-Type).

Bibliography: Schweingruber 1990: 616-627.

Plate 5 – g

Ubiquity: KH-P I, 6/25; KH-P IIA, 1/1; KH-P IIB, 10/38; KH-P III, 25/47; KH-P IV, 15/31; KH-P VA, 5/10; KH-P VI, 1/2

Count: KH-P I, 11/444; KH-P IIA, 1/49; KH-P IIB, 85/1405; KH-P III, 130/2328; KH-P IV, 105/1461; KH-P VA, 13/458; KH-P VI, 1/92

SALICACEAE

- **Salicaceae** s.l. – willow or poplar

23 species of *Salix* and 4 species of *Populus* are described in the Flora of Turkey.

Wood anatomy: wood with a diffuse porosity, with pores solitary or in small radial files. Perforation plates are simple. Rays are uniseriate rays, homogeneous (*Populus* spp.) or slightly heterogeneous (*Salix* spp.) and characterized by very large ray-vessel pits.

Identification notes: the observation of anatomic features in uniseriate rays is often problematic, the identification is accordingly kept at the family level, without aiming to distinguish between *Populus* and *Salix*. In 5 fragments from a single sample (KIN17C2837s56) the ray anatomy is not fully observable, because of strong deformation and very small diameter; those specimens are identified as cf. Salicaceae.

Bibliography: Schweingruber 1990: 672-679.

Plate 5 – h; 6 – a

Ubiquity: KH-P I, 16/25; KH-P IIA, 1/1; KH-P IIB, 19/38; KH-P III, 25/47; KH-P IV, 24/31; KH-P VA, 8/10; KH-P VB, 9/9; KH-P VI, 2/2

Count: KH-P I, 62/444; KH-P IIA, 2/49; KH-P IIB, 60/1405; KH-P III, 94/2328; KH-P IV, 380/1461; KH-P VA, 41/458; KH-P VB, 230/591; KH-P VI, 5/92

TAMARICACEAE

- ***Tamarix*** **sp.** – tamarisk

5 species of *Tamarix* are described in the Flora of Turkey: *T. hampeana, T. gracilis, T. smyrnensis, T. parviflora, T. tetranda.*

Wood anatomy: wood with a ring to semi-ring porosity, pores are solitary or in small groups. Paratracheal parenchyma is present. Rays are heterogeneous (1 to 2 squared or upright marginal cells), large (6-20 cells) and high (up to 2 mm). Perforation plates are simple.

Identification notes: 4 fragments from a single sample (KIN15A1668s85) show all the character of *Tamarix*, except than a porosity more diffuse than expected; those specimens are identified as cf. *Tamarix* sp.

Bibliography: Schweingruber 1990: 708-709.

Plate 6 – b

Ubiquity: KH-P I, 1/25; KH-P III, 2/47; KH-P VA, 1/10

Count: KH-P I, 1/444; KH-P III, 2/2328; KH-P VA, 1/458

ULMACEAE

- **Ulmaceae s.l.** – maple family

In the Flora of Turkey, the following species are included in the Ulmaceae family*: Ulmus laevis, U. glabra, U. Minor; Celtis australis, C. caucasica, C. tournefortii, C. glabrata; Zelkova carpinifolia*.

Wood anatomy: ring porous wood, with large earlywood pores. Latewood pores are arranged in tangential, diagonal, or dendritic patterns. Vessels are with simple perforation plates and helical thickenings. Rays are 3- to 7-seriate. The anatomy of the ray is diagnostic of the genus.

Identification notes: charcoal fragments were identified at the family level in the cases in which the ray anatomy was not clearly observable. In current taxonomy, *Celtis* sp. has been reassigned to the Cannabaceae family.

Bibliography: Schweingruber 1990: 724-727.

Ubiquity: KH-P IIB, 1/38; KH-P IV, 3/31

Count: KH-P IIB, 1/1405; KH-P IV, 3/1461

- **Celtis sp.** – hackberry

4 species of Celtis are described in the Flora of Turkey: *Celtis australis, C. caucasica, C. tournefortii, C. glabrata*.

Wood anatomy: general characteristic of Ulmaceae. Rays are heterogeneous, with few rows of upright and squared marginal cells.

Identification notes: 3 specimens originating from a single sample (KIN15A1539s77) showing immature wood (2-year old cut) anatomy are identified as cf. *Celtis* sp.

Bibliography: Schweingruber 1990: 724-725.

Ubiquity: KH-P III, 2/47; KH-P VI, 1/2

Count: KH-P III, 2/2328; KH-P VI, 1/92

- ***Ulmus* sp.** – elm

3 species of Ulmus are described in the Flora of Turkey: *Ulmus laevis, U. glabra, U. Minor*.

Wood anatomy: general characteristics of Ulmaceae. In most instances, rays are homogeneous, only rarely heterogenous of type I.

Identification notes: the absence of crystals in ray parenchyma cells allows to exclude confusion with *Zelkova* sp.

Bibliography: Schweingruber 1990: 726-727

Plate 6 – c, d

Ubiquity: KH-P I, 1/25; KH-P IIB, 2/38; KH-P III, 3/47; KH-P IV, 2/31; KH-P VA, 2/10; KH-P VI, 2/2

Count: KH-P I, 1/444; KH-P IIB, 2/1405; KH-P III, 9/2328; KH-P IV, 9/1461; KH-P VA, 4/458; KH-P VI, 2/92

VITACEAE

- ***Vitis vinifera*** – grapevine

Cultivated vines producing edible fruits.

Wood anatomy: wood with diffuse porosity. Earlywood pores are large, latewood pores are generally radially oriented. Rays are 5- to 20-seriate, very high (also more than 2 mm), homogeneous to heterogeneous. Scalariform intervascular pitting is present. Perforation plates are usually simple, sometimes scalariform in small vessels.

Identification notes: easily distinguished on the basis of the characteristic porosity, high multiseriate rays, and distinctive scalariform intervascular pitting. Some fragments are attributed to cf. *Vitis vinifera*, mainly because of atypical porosity (pores relatively smaller than expected) - which, however, should be expected within the range of variability in the grapevine anatomy (e.g., in the "flattened zone", see Limier et al 2018). On phytogeographic basis, other species of *Vitis* are not considered.

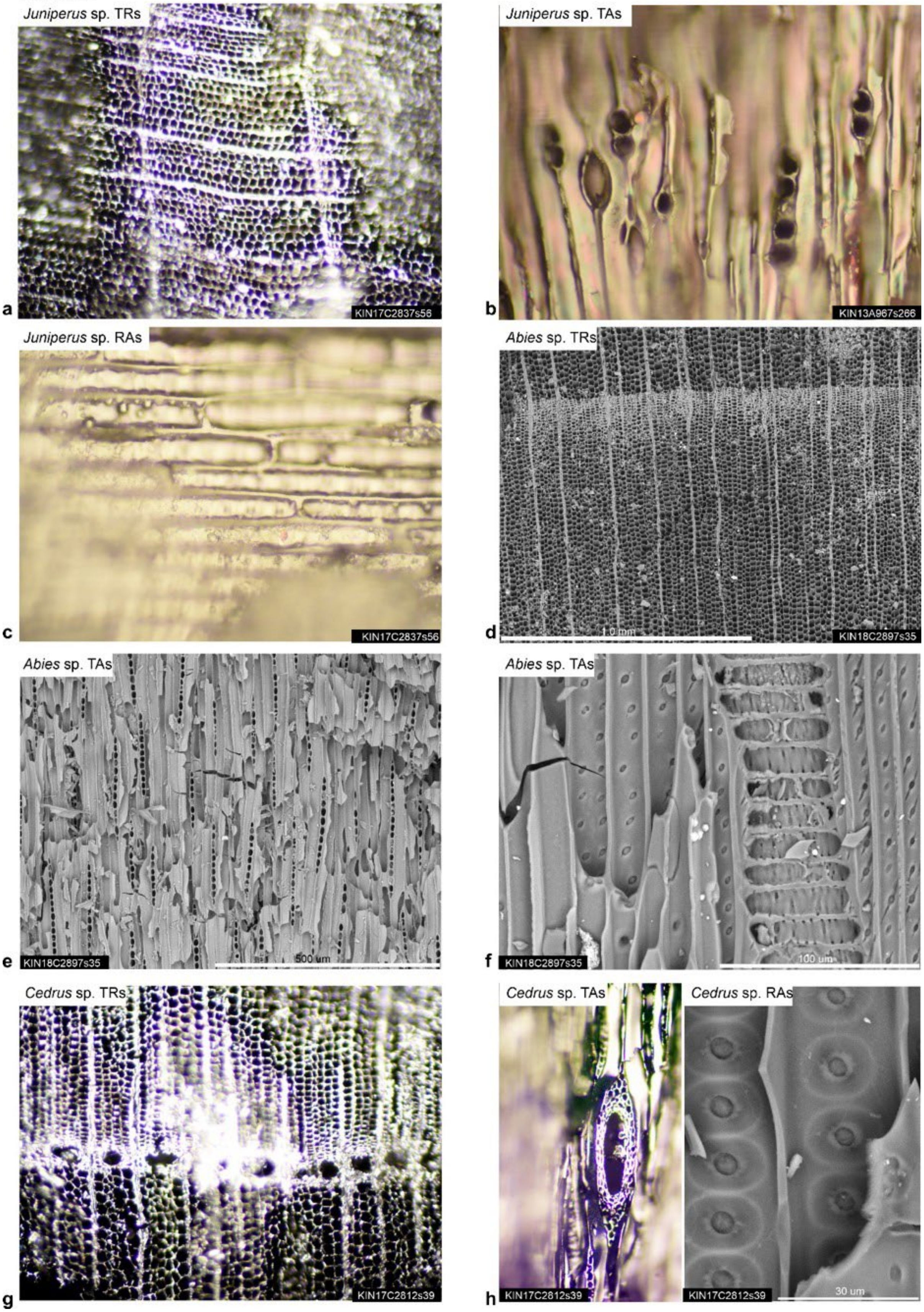
Bibliography: Schweingruber 1990: 734-735.

Plate 6 – e, f, g, h

Ubiquity: KH-P I, 13/25; KH-P IIA, 1/1; KH-P IIB, 24/38; KH-P III, 35/47; KH-P IV, 14/31; KH-P VA, 5/10

Count: KH-P I, 48/444; KH-P IIA, 14/49; KH-P IIB, 331/1405; KH-P III, 335/2328; KH-P IV, 44/1461; KH-P VA, 10/45.

PLATE 1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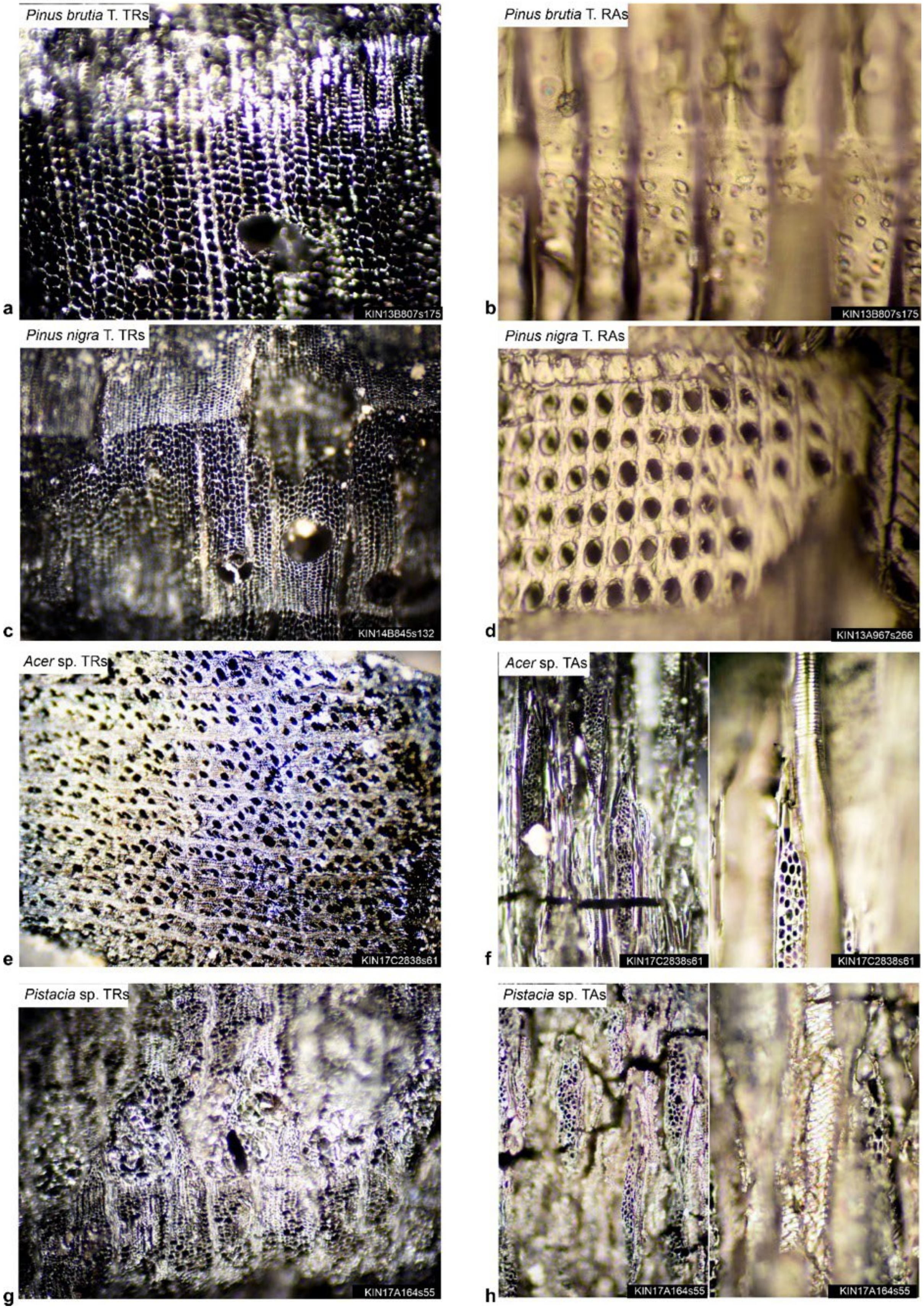
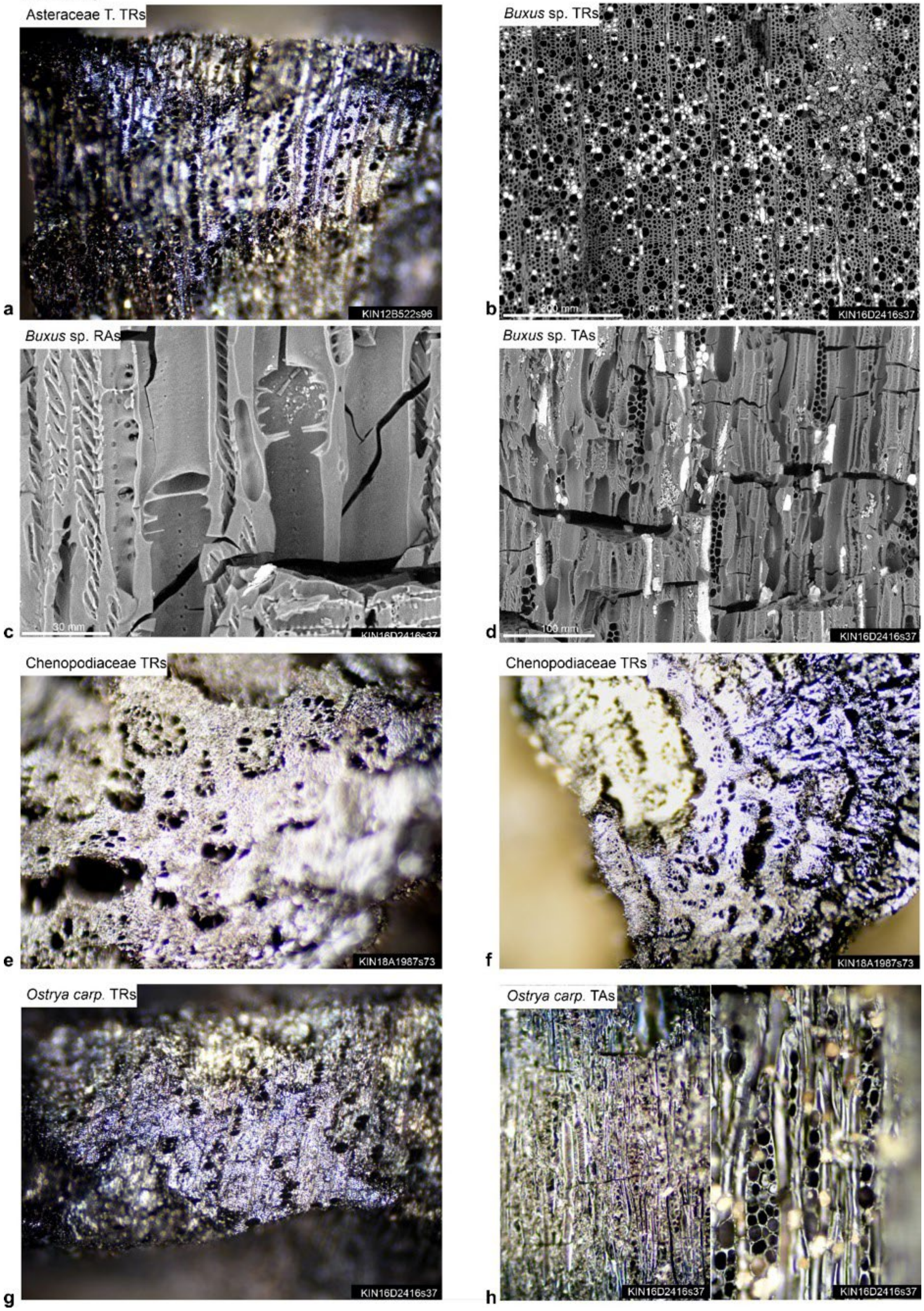
Juniperus sp. TAs
b
KIN13A967s266
Juniperus sp. RAs
c
KIN17C2837s56
Abies sp. TRs
d
1.0 mm
KIN18C2897s35
Abies sp. TAs
e
KIN18C2897s35
500 um
Abies sp. TAs
f
KIN18C2897s35
100 um
Cedrus sp. TRs
g
KIN17C2812s39
Cedrus sp. TAs
Cedrus sp. RAs
h
KIN17C2812s39
KIN17C2812s39
30 um

PLATE 2



Pinus brutia T. TRs
a
KIN13B807s175
Pinus brutia T. RAs
b
KIN13B807s175
Pinus nigra T. TRs
c
KIN14B845s132
Pinus nigra T. RAs
d
KIN13A967s266
Acer sp. TRs
e
KIN17C2838s61
Acer sp. TAs
f
KIN17C2838s61
KIN17C2838s61
Pistacia sp. TRs
g
KIN17A164s55
Pistacia sp. TAs
h
KIN17A164s55
KIN17A164s55

PLATE 3


Asteraceae T. TRs
a
KIN12B522s96
Buxus sp. TRs
b
200 mm
KIN16D2416s37
Buxus sp. RAs
c
30 mm
KIN16D2416s37
Buxus sp. TAs
d
100 mm
KIN16D2416s37
Chenopodiaceae TRs
e
KIN18A1987s73
Chenopodiaceae TRs
f
KIN18A1987s73
Ostrya carp. TRs
g
KIN16D2416s37
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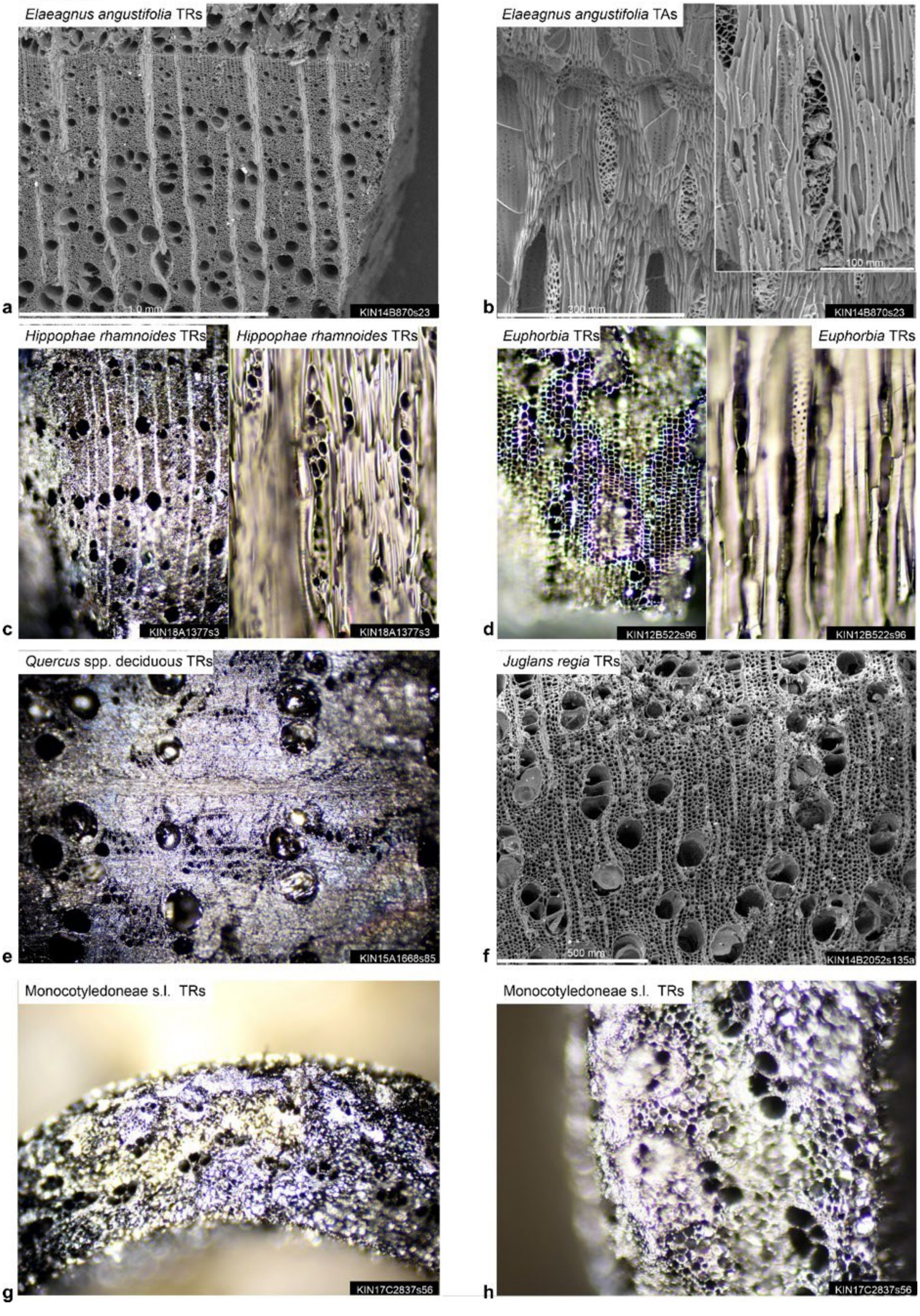
h
KIN16D2416s37
KIN16D2416s37

PLATE 4



Elaeagnus angustifolia TRs

Elaeagnus angustifolia TAs

Hippophae rhamnoides TRs

Hippophae rhamnoides TRs

Euphorbia TRs

Euphorbia TRs

Quercus spp. deciduous TRs

Juglans regia TRs

Monocotyledoneae s.l. TRs

Monocotyledoneae s.l. TRs

a
1.0 mm
KIN14B870s23
b
300 mm
100 mm
KIN14B870s23
c
KIN18A1377s3
KIN18A1377s3
d
KIN12B522s96
KIN12B522s96
e
KIN15A1668s85
f
500 mm
KIN14B2052s135a
g
KIN17C2837s56
h
KIN17C2837s56

PLATE 5

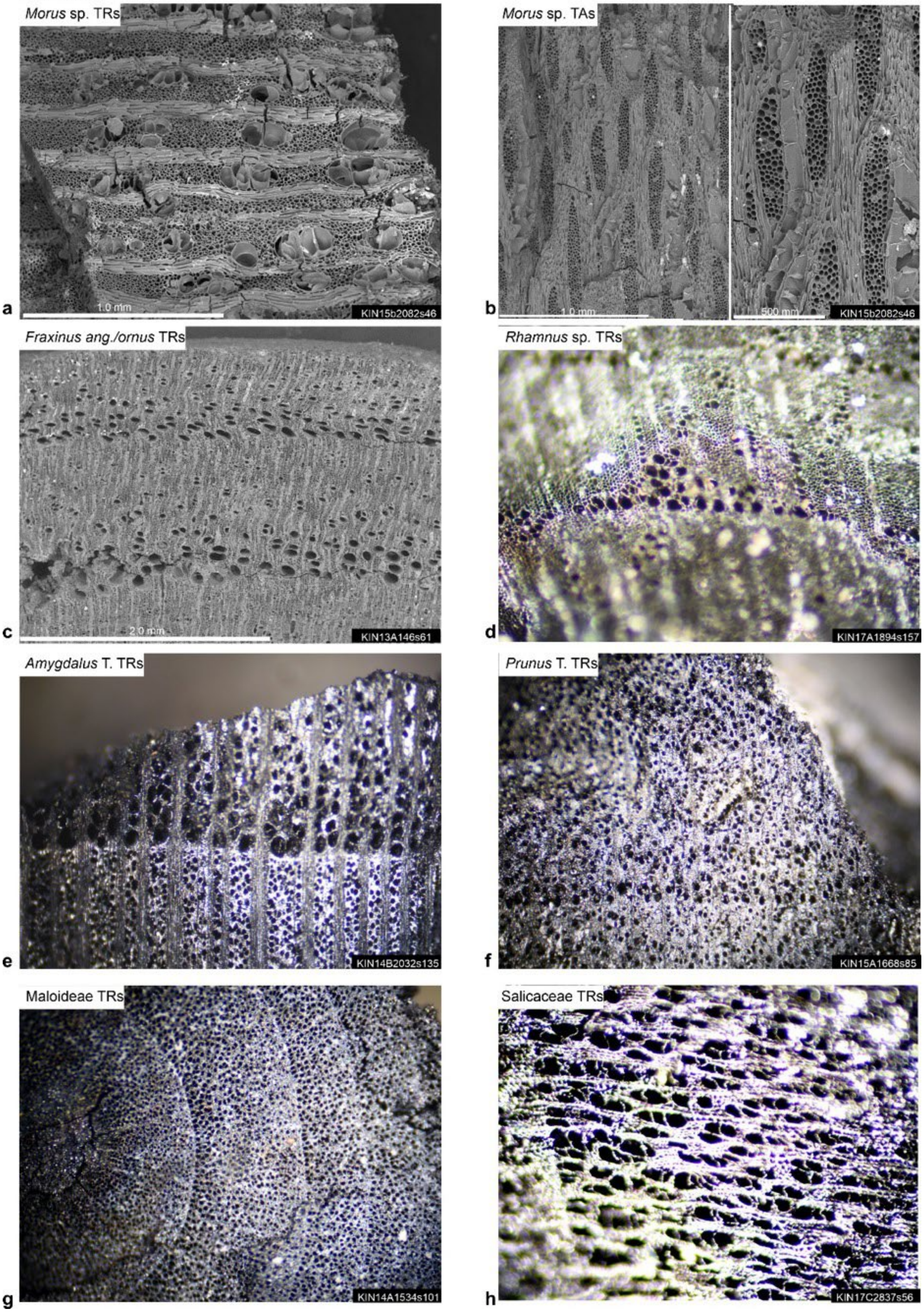
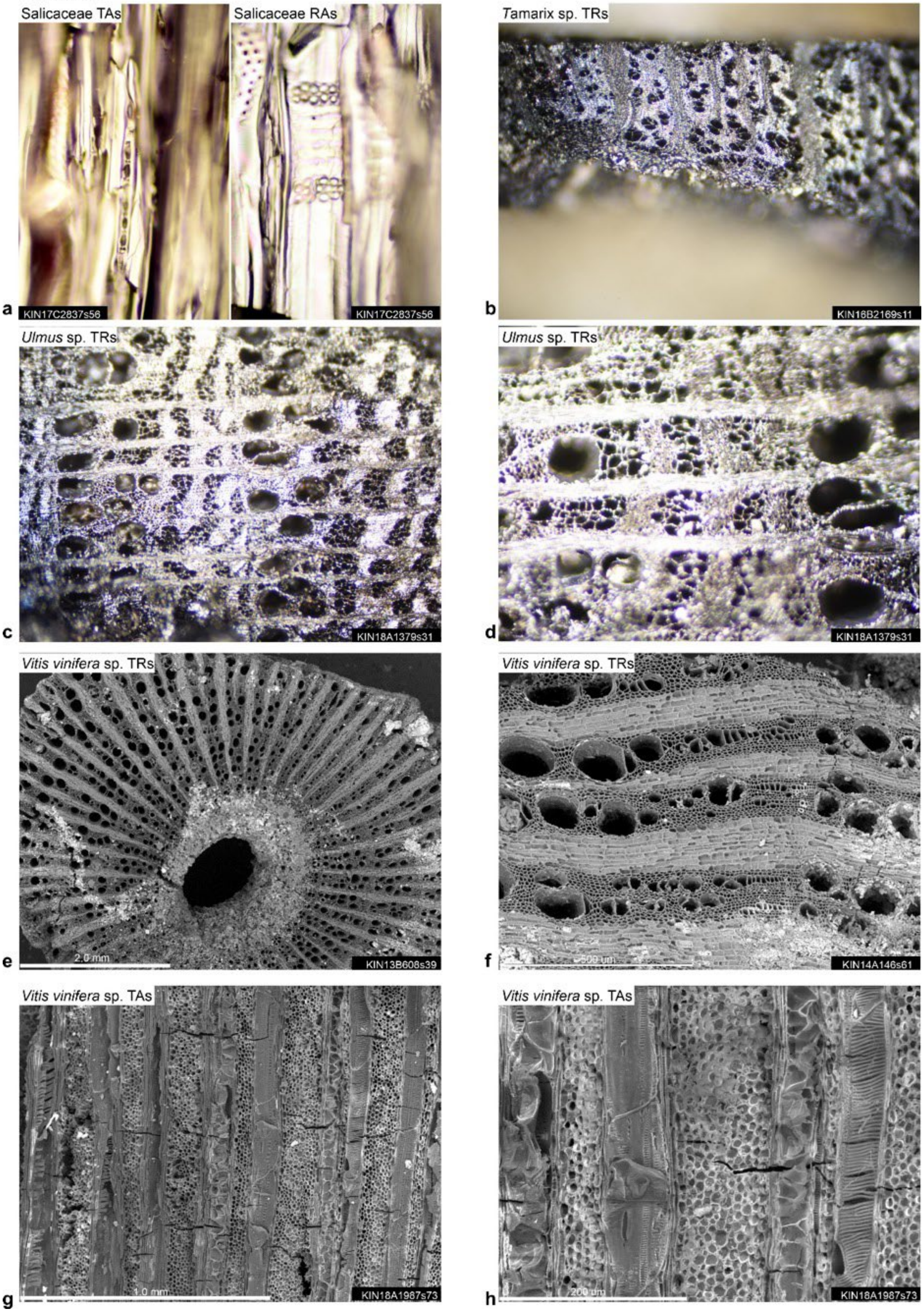

Morus sp. TRs
a
1.0 mm
KIN15b2082s46
Morus sp. TAs
b
1.0 mm
500 mm
KIN15b2082s46
Fraxinus ang./ornus TRs
c
2.0 mm
KIN13A146s61
Rhamnus sp. TRs
d
KIN17A1894s157
Amygdalus T. TRs
e
KIN14B2032s135
Prunus T. TRs
f
KIN15A1668s85
Maloideae TRs
g
KIN14A1534s101
Salicaceae TRs
h
KIN17C2837s56

PLATE 6


Salicaceae TAs
Salicaceae RAs
a
KIN17C2837s56
KIN17C2837s56
Tamarix sp. TRs
b
KIN16B2169s11
Ulmus sp. TRs
c
KIN18A1379s31
Ulmus sp. TRs
d
KIN18A1379s31
Vitis vinifera sp. TRs
e
2.0 mm
KIN13B608s39
Vitis vinifera sp. TRs
f
500 µm
KIN14A146s61
Vitis vinifera sp. TAs
g
1.0 mm
KIN18A1987s73
Vitis vinifera sp. TAs
h
200 µm
KIN18A1987s73

APPENDIX 5

Wood charcoal analysis of samples from Niğde-Kınık Höyük: sample-by-sample count and weight data

In this appendix I am providing the sample-by-sample results of the wood charcoal study presented in Chapter 5. For the absolute dating of the Niğde-Kınık Höyük periods, see Chapter 3 (especially Table 3.1). Information on samples preparations and metrics are provided in Appendix 3. For identification criteria and candidate taxa in the Turkish flora, see Appendix 4. Taxonomy follows the Flora of Turkey (Davis 1965-1985).

Anthracological results – count data_____712

Anthracological results – weight data_____734

		KIN16B2169s11	KIN16B502s13	KIN12B488s18	KIN12B727s417	KIN13B638s60	KIN13B644s67	KIN14B855s4	KIN14B860S15
	Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
	Trench	B	B	B	B	B	B	B	B
	Phase	B.1-2	B.1-2	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a
	Context type	layer (acc.)	debris	pyro	debris	pit fill	pit fill	layer (acc.)	surface
	Context class	long-term	short-term	short-term	short-term	long-term	long-term	long-term	short-term
	Soil (ml)	16250	6200	3500	3500	6000	16000	9250	10000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	—	—	—	3	—	
Pinus brutia -type (Turkish or Aleppo pine)	count	—	1	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	6	—	1	—	5	1	—	2
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	1	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	16	2	5	—	—	—	2	4
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	1	2	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	1	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	1	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	1
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	1	2	—	1
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	1	—	—	—	2	—	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	7	50	—	—	1	—
Prunus -type (plums type)	count	1	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	2	1	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	17	—	—	—	—	2	—	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	2	—	—	—	3	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	2	1	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	—	—	—	—
Indeterminable broadleaf	count	—	1	—	—	1	1	—	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	count	48	7	13	50	14	10	4	8
Total charcoal	weight total	2.18	0.42	1.02	85.73	0.37	0.19	0.10	0.30
4mmCharcoalCONC	wg/10liter	0.0134	0.0068	0.0291	2.4494	0.0062	0.0012	0.0011	0.0030

		KIN14B865s17	**KIN14B870s23**	**KIN12B522s96**	**KIN12B562s158**	**KIN12B563s160**	**KIN12B520s93**	**KIN12B540s130**	**KIN13B617s26**
	Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
	Trench	B	B	B	B	B	B	B	B
	Phase	B.1a	B.1a	B.1a-b	B.1a-b	B.1a-b	B.1b	B.1b	B.1b
	Context type	layer (acc.)	pyro	pit fill	pit fill	pit fill	surface	pit fill	layer (acc.)
	Context class	long-term	short-term	long-term	long-term	long-term	short-term	long-term	long-term
	Soil (ml)	9500	7800	10000	10000	1000	10000	10000	10000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	1	1	—	—	—	—	—	9
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	7
Juniperus sp. (juniper)	count	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	1	—	12	—	4	—	1	6
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	1	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	10	3	—	—	7	1	9	—
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	1	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	3	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	1	—	—	—	1	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	1	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	1	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	1	—	—
Amygdalus -type (almond type)	count	—	12	—	—	—	—	—	2
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	1	12	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	6	—	—	—	—	1	3
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	7	—	—	—	—	8
Euphorbia sp. (spurges)	count	—	—	1	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	1	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	—	—	1	—
Indeterminable broadleaf	count	—	—	—	—	—	—	1	—
Indeterminable conifer	count	—	—	—	—	—	—	—	1
root broadleaf	count	—	1	—	—	—	—	—	—
bark	count	—	—	2	—	—	—	—	3
Sums									
Analyzed charcoal	count	14	36	26	1	12	4	13	39
Total charcoal	weight total	0.78	1.23	0.48	0.03	0.46	0.11	0.56	1.56
4mmCharcoalCONC	wg/10liter	0.0082	0.0158	0.0048	0.0003	0.0460	0.0011	0.0056	0.0156

		KIN14B856s3	KIN12B534s123	KIN13B608s39	KIN13B633s45	KIN13B636s53	KIN13B762s122	KIN13B789s155	KIN14B895s78
	Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
	Trench	B	B	B	B	B	B	B	B
	Phase	B.1b	B.2	B.2	B.2	B.2	B.2	B.2	B.2
	Context type	layer (acc.)	surface	pit fill	pit fill	layer (acc.)	pit fill	layer (acc.)	pithos fill
	Context class	long-term	short-term	long-term	long-term	long-term	long-term	long-term	short-term
	Soil (ml)	6500	10000	10000	7500	9000	14500	15000	10000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	—	3	—	1	2	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	3	3	—	13	—	1	1	—
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	1	15	11	—	3	4	5	3
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	2	—	1	1	2	—	3	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	1	0	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	3	—	—
Maloideae (apple subfamily)	count	2	1	—	—	3	—	2	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	4	2	—	5	—	—	1	1
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	1	1	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	1	—	—	—	—	—
Vitis vinifera (grapevine)	count	1	3	3	2	—	4	1	2
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	1	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	1	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	1	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	1	—	—	—	—	—	—
Indeterminable broadleaf	count	—	—	1	—	—	1	1	—
Indeterminable conifer	count	—	1	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	1	—	—	—	1
Sums									
Analyzed charcoal	count	13	26	18	27	9	15	17	7
Total charcoal	weight total	0.86	1.63	1.02	2.02	0.26	0.77	0.59	0.40
4mmCharcoalCONC	wg/10liter	0.0132	0.0163	0.0102	0.0269	0.0029	0.0053	0.0039	0.0040

		KIN15B2082s42	**KIN13A146s61**	**KIN14A131s138**	**KIN17A1830s12**	**KIN18A1974s70**	**KIN18A1987s73**	**KIN14A1502s44**	**KIN14A1512s48**
	Period	KH-P I	KH-P IIA	KH-P IIA	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	B	A1	A1	A1	A1	A1	A1	A1
	Phase	B.2	A1.1a	A1.1a	A1.1	A1.1	A1.1	A1.1a/b	A1.1b
	Context type	pit fill	surface	debris	pit fill	layer (acc.)	layer (acc.)	layer (acc.)	pyro
	Context class	long-term	short-term	short-term	long-term	long-term	long-term	long-term	short-term
	Soil (ml)	26500	10000	9000	8000	20000	18000	7150	3800
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	1	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	2	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	2	2	—	—	7	—	1	—
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	1	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	—	15	—	—	121	86	5	2
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	1	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	11	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	3	7	2	6
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	1	—	2
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	2	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	1	—	—	8	2	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	3	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	3	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	1	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	3	14	—	3	19	3	1	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	1	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	1	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	1	—	—	—
Indeterminable broadleaf	count	1	1	—	—	4	—	—	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	3	—	—	—
Sums									
Analyzed charcoal	count	13	49	0	3	169	100	10	10
Total charcoal	weight total	0.63	2.88	0.00	0.13	12.45	23.46	0.57	0.27
4mmCharcoalCONC	wg/10liter	0.0024	2.8800	0.0000	0.1625	6.2250	13.0333	0.7972	0.7105

		KIN14A1534s101	KIN14A1540s98	KIN15A1539S77	KIN15A1607S11	KIN12A233s261	KIN12A233s273	KIN12A237s238	KIN13A939s257
	Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	A1	A1	A1	A1	A2	A2	A2	A2
	Phase	A1.1c	A1.1c	A1.1c	A1.1c	A2.2	A2.2	A2.2	A2.2
	Context type	surface	pyro	layer (acc.)	layer (acc.)	pit fill	pit fill	other fill	pit fill
	Context class	short-term	short-term	long-term	long-term	long-term	long-term	short-term	long-term
	Soil (ml)	10450	650	8500	7750	2000	8000	3000	13000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	1	1	3	—	—	—	1	1
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	3	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	9	—	29	49	1	1	15	2
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	5	—	3	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	6	—	1	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	18	—	21	—	—	—	4	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	2	73	3	—	—	—	4	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	3	—	—	—	—	3
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	6	—	—	—	—	—
Indeterminable broadleaf	count	3	1	1	—	—	—	2	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	1	—	—	—	—
Sums									
Analyzed charcoal	count	44	75	73	50	1	1	26	6
Total charcoal	weight total	1.57	56.31	6.79	19.21	0.02	0.04	1.27	0.19
4mmCharcoalCONC	wg/10liter	1.5024	866.3077	7.9882	24.7871	0.1000	0.0500	4.2333	0.1462

		KIN13A950s242	KIN13A967s266	KIN13A972s304	KIN13A982s293	KIN14B803s113	KIN12B560s156	KIN15B2109s93	KIN16B2221s119
	Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	A2	A2	A2	A2	B	B	B	B
	Phase	A2.2	A2.2	A2.2	A2.2	B.3a	B.3b/4a	B.3b/4a	B.3b/4a
	Context type	pit fill	layer (acc.)	pit fill	pit fill	surface	layer (acc.)	layer (acc.)	surface
	Context class	long-term	long-term	long-term	long-term	short-term	long-term	long-term	short-term
	Soil (ml)	14000	11000	19000	16000	90	10000	16000	16500
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	1	—	1	1	1	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	1	—	2	2	—	—	—	—
Juniperus sp. (juniper)	count	—	3	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	1	2	—	5	—	—	5	—
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	2	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	1	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	5	6	1	3	—	18	—	11
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	1	—	—	—	—	6	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	1	—	—	1	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	25	—	—	—	—	—	2
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	1	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	28	—	—	1	1	88	1
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	1	1	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	1	—	—	—
Indeterminable broadleaf	count	—	5	2	—	—	—	—	1
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	count	9	74	7	12	3	20	100	15
Total charcoal	weight total	0.34	5.29	0.31	0.59	0.08	1.12	10.15	1.40
4mmCharcoalCONC	wg/10liter	0.2429	4.8091	0.1632	0.3688	8.8889	1.1200	6.3438	0.8485

		KIN15B2113s108	KIN15B2111s116	KIN12B549s138	KIN16B2181s34	KIN16B2196s59	KIN13B767s126	KIN14B2018s120	KIN14B2031s133
	Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	B	B	B	B	B	B	B	B
	Phase	B.4	B.4a	B.4a/b	B.4b	B.4b/c	B.4c	B.4c	B.4c
	Context type	pyro	layer (acc.)	surface	layer (acc.)	layer (acc.)	pyro	surface	pithos fill
	Context class	short-term	long-term	short-term	long-term	long-term	short-term	short-term	short-term
	Soil (ml)	6000	3000	nr	7250	17000	20000	nr	27000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	—	—	—	—	—	1
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	3
Juniperus sp. (juniper)	count	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	—	—	5	1	2	—	4	3
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	4	—	63	7	36	13	74	6
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	3	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	6	—	—
Elaeagnus angustifolia (Russian olive)	count	1	—	—	1	—	—	—	1
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	1	—	3	—	—	—	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	1	—	—	—	—	—
Prunus -type (plums type)	count	1	—	—	—	—	6	1	—
Amygdalus/Prunus (almond/plums type)	count	1	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	1	50	1	—	—	1	1	6
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	1	1	—	—	1	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	2	—	—	—	—	—
Indeterminable broadleaf	count	—	—	2	—	3	—	—	1
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	1	—	1	—	—	1	1
Sums									
Analyzed charcoal	count	9	51	81	11	41	26	82	22
Total charcoal	weight total	0.93	1.38	5.50	0.63	3.60	1.35	9.65	1.52
4mmCharcoalCONC	wg/10liter	1.5500	4.6000	nr	0.8690	2.1176	0.6750	nr	0.5630

		KIN14B2032s135_a	KIN14B2032s135_b	KIN14B2032s140	KIN14B845s132	KIN15B2091s57	KIN15B2098s77	KIN15B2107s86	KIN13D1044s25
	Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	B	B	B	B	B	B	B	D
	Phase	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	D.2a
	Context type	pyro	pyro	pyro	pithos fill	layer (acc.)	pithos fill	layer (acc.)	pit fill
	Context class	short-term	short-term	short-term	short-term	long-term	short-term	long-term	long-term
	Soil (ml)	4500	4000	4500	3150	3000	20250	10000	900
Conifers									
Abies sp. (fir)	count	1	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	4	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	8	—	3	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	6	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	14	—	—	—	—	—	1	—
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	1	4	8	7	12	3	1	—
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	6	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	5	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	7	1	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	8	1	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	73	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	1	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	—	—	3	1	1	—	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	6	2	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	count	1	1	—	1	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	—	—	—	—
Indeterminable broadleaf	count	3	—	—	1	—	—	—	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	count	129	21	10	15	13	5	2	0
Total charcoal	weight total	10.87	0.82	0.60	0.84	0.87	0.15	0.04	0.00
4mmCharcoalCONC	wg/10liter	24.1556	2.0500	1.3333	2.6667	2.9000	0.0741	0.0400	0.0000

		KIN13D1070s71	KIN13D1041s23	KIN13A175s117	KIN15A1668s85	KIN15A1676s93	KIN15A1685s131	KIN16A1683s4	KIN16A1685s52
	Period	KH-P IIB	KH-P IIB	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	D	D	A1	A1	A1	A1	A1	A1
	Phase	D.2a	D.2a/b	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a
	Context type	pyro	pit fill	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)
	Context class	short-term	long-term	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	12000	3000	10000	8000	6500	11000	20750	18000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	1	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	2	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	—	—	5	—	—	—	3	1
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	1	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	4	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	7	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	—	2	52	56	101	64	139	122
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	1
Acer spp. (maple)	count	—	—	—	—	—	—	3	1
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	2	—	—	1	5	3
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	2	—	3	—	—	1
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	2	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	4	26	2	3	14	11
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	1
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	4
Prunus -type (plums type)	count	—	—	1	4	4	—	2	7
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	1	2	—	1
cf *Prunus-type* (cf plums-type)	count	—	—	—	1	—	—	—	—
Vitis vinifera (grapevine)	count	25	—	11	78	13	5	29	31
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	2	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	1	22	4	3	—	4
Indeterminable broadleaf	count	—	1	6	1	10	5	3	10
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	8	8	—	1	2
Sums									
Analyzed charcoal	count	27	3	86	200	156	83	200	200
Total charcoal	weight total	1.36	0.24	4.94	44.93	7.05	5.67	45.58	14.41
4mmCharcoalCONC	wg/10liter	1.1333	0.8000	0.0494	0.5616	0.1085	0.0515	0.2197	0.0801

		KIN16A1689s26	**KIN16A1711s67**	**KIN16A1721s55**	**KIN16A1732s70**	**KIN16A1745s95**	**KIN18A1996s91**	**KIN18A3610s123**	**KIN17A1771s64**
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	A1	A1	A1	A1	A1	A1	A1	A1
	Phase	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2b
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	pyro	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	short-term	long-term
	Soil (ml)	17000	18250	10750	6200	13750	28000	18000	28000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	1	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	—	—	1	—
Riparian vegetation									
Salicaceae (willow family)	count	3	1	—	—	15	—	1	—
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	59	65	71	48	33	89	89	6
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	2	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	1	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	1	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	26	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	1	2	—	—	—	—	1	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	1	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	1	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	10	19	15	1	1	1	2	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	2	—	—	—	—	4	—	—
Prunus -type (plums type)	count	3	1	2	1	—	1	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	1	—	—	—
Vitis vinifera (grapevine)	count	19	19	33	5	28	3	—	—
cf *Vitis vinifera (cf grapevine)*	count	1	2	1	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	1	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	2	—	—	—
Monocotyledonae (monocots)	count	—	—	1	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	3	4	3	—	—	—	—	—
Indeterminable broadleaf	count	5	1	5	3	7	—	—	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	1	5	5	6	1	2	3	1
Sums									
Analyzed charcoal	count	135	121	136	64	89	100	100	7
Total charcoal	weight total	8.92	8.56	10.88	3.69	4.01	32.84	nr	0.65
4mmCharcoalCONC	wg/10liter	0.0525	0.0469	0.1012	0.0595	0.0292	11.7286	nr	0.0023

		KIN17A1771s65	**KIN17A1771s66**	**KIN17A1771s67**	**KIN18A1902s4**	**KIN17A1790s135**	**KIN17A1893s149**	**KIN17A1894s157**	**KIN17A1894s158**
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	A1	A1	A1	A1	A1	A1	A1	A1
	Phase	A1.2b	A1.2b	A1.2b	A1.2b	A1.3	A1.3	A1.3	A1.3
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	30000	10000	20000	18000	20000	20000	30000	10000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	1	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	1	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	2	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	—	—	—	1	8	9	7	—
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	1	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	1	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	3	—	4	15	19	40	38	—
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	8	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	1	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	1	—	2	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	1	2	2	—	2	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	2	1	1	—	—
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	2	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	1	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	—	—	4	5	3	1	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	1	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	1	1	1	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	1	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	1	—	—	—
Indeterminable	count	—	—	—	—	—	1	2	—
Indeterminable broadleaf	count	—	—	—	—	1	2	1	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	1	—	—	—	—	1	—	—
Sums									
Analyzed charcoal	count	5	0	5	25	44	68	57	0
Total charcoal	weight total	0.31	0.00	0.17	1.64	2.03	3.90	2.91	0.00
4mmCharcoalCONC	wg/10liter	0.0010	0.0000	0.0009	0.0091	0.0102	0.0195	0.0097	0.0000

		KIN12A231s258	KIN12A231s260	KIN13B790s152	KIN14B899s91	KIN13B802s162	KIN13B804s167	KIN14B2002s105	KIN14B2002s106_a
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	A2	A2	B	B	B	B	B	B
	Phase	A2.3	A2.3	B.5	B.5b-6a	B.6	B.6	B.6b	B.6b
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	pyro	pyro
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	short-term	short-term
	Soil (ml)	3500	9500	10000	10000	10000	10000	1000	10000
Conifers									
Abies sp. (fir)	count	—	—	—	1	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	1	—	—	1	—	1
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	1	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	—	—	1	1	1	1	—	1
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	1	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	—	2	14	16	12	26	4	15
Hippophae rhamnoides (seaberry)	count	—	2	—	—	—	4	—	13
Acer spp. (maple)	count	—	—	—	—	—	1	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	1	—	—	1	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	1	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	—	1	—	—	—	—
Prunus -type (plums type)	count	—	—	1	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	1	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	7	—	2	1	—	—	1
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	2	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	1	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	—	—	—	—
Indeterminable broadleaf	count	—	1	—	1	2	1	—	2
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	1	1	—	1	—	1
Sums									
Analyzed charcoal	count	0	12	24	23	17	37	4	34
Total charcoal	weight total	0.00	0.30	1.08	1.76	1.89	2.17	0.16	1.48
4mmCharcoalCONC	wg/10liter	0.0000	0.0032	0.0108	0.0176	0.0189	0.0217	0.0160	0.0148

		KIN14B2002s106_b	KIN13B807s175	KIN14B807s125	KIN14B807s38_a	KIN14B807s38_b	KIN14B817s33	KIN14B876s115	KIN15D2379s117
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	B	B	B	B	B	B	B	D
	Phase	B.6b	B.7	B.7	B.7	B.7	B.7	B.7	D.3
	Context type	pyro	bin fill	bin fill	bin fill	bin fill	debris	surface	layer (acc.)
	Context class	short-term	long-term	long-term	long-term	long-term	short-term	short-term	long-term
	Soil (ml)	6000	14000	8500	3000	3000	9000	7500	15500
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	—	—	—	2	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	1	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	1	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	1	17	6	1	2	2	—	4
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	1	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	5	25	21	11	4	10	15	3
Hippophae rhamnoides (seaberry)	count	5	—	—	—	—	2	6	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	1	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	1
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	3	—	5	1	1	1	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	1	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	3	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	1	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	2	1	8	4	—	1	1	4
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	2	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	1	1	1	—	—
Monocotyledonae (monocots)	count	—	2	1	—	2	1	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	1	—	—	—
Indeterminable broadleaf	count	1	1	2	3	—	1	1	3
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	1	—	—	1	—	1	1	1
Sums									
Analyzed charcoal	count	20	49	49	22	11	22	24	16
Total charcoal	weight total	1.10	2.83	2.23	1.16	0.46	1.04	1.48	1.18
4mmCharcoalCONC	wg/10liter	0.0183	0.0202	0.0262	0.0387	0.0153	0.0116	0.0197	0.0076

		KIN13D1073s67	**KIN13D1144s185**	**KIN14D1124s4**	**KIN14D1149s73**	**KIN14D1155s20**	**KIN14D1109s95**	**KIN14D1166s138**	**KIN14D1166s52_a**
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	D	D	D	D	D	D	D	D
	Phase	D.3a	D.3a	D.3a	D.3a	D.3a	D.3b	D.3b	D.3b
	Context type	layer (acc.)	layer (acc.)	surface	surface	layer (acc.)	surface	pyro	pyro
	Context class	long-term	long-term	short-term	short-term	long-term	short-term	short-term	short-term
	Soil (ml)	2500	4800	4500	2500	9500	1500	9000	3600
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	—	—	1	—
Riparian vegetation									
Salicaceae (willow family)	count	—	—	—	—	1	—	1	—
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	1	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	—	1	—	4	1	—	7	—
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	1	—	—	—	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	2
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	1	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	—	—	1	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	—	1	—	7	—	2	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	8	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	1	—	—	—
Monocotyledonae (monocots)	count	—	—	—	2	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	1	—	—	—	—	—
Indeterminable broadleaf	count	—	—	—	—	1	—	1	1
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	count	0	1	3	6	11	0	23	3
Total charcoal	weight total	0.00	0.04	0.14	0.20	0.77	0.00	1.54	0.17
4mmCharcoalCONC	wg/10liter	0.0000	0.0008	0.0031	0.0080	0.0081	0.0000	0.0171	0.0047

		KIN14D1166s52_b	KIN14D2302s102	KIN14D2314s140	KIN15D2376s140	KIN14D1192s101	KIN14D1192s88	KIN15D2385s150	KIN15D2313s74
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	D	D	D	D	D	D	D	D
	Phase	D.3b	D.3b	D.3b	D.3b	D.3c	D.3c	D.3c	D.4a
	Context type	pyro	pyro	surface	pit fill	pyro	pyro	surface	pyro
	Context class	short-term	short-term	short-term	long-term	short-term	short-term	short-term	short-term
	Soil (ml)	2600	10000	8000	17500	3000	9000	12000	7500
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	—	—	—	—	1	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	count	—	—	—	—	—	—	—	—
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	—	2	3	2	—	—	1	—
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	—	—	1	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	1	1	1	—	—	2	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	1	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	1	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—	1	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	—	—	—	—
Indeterminable broadleaf	count	—	—	2	—	—	—	1	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	count	0	3	6	3	0	0	9	0
Total charcoal	weight total	0.00	0.50	0.15	0.20	0.00	0.00	0.40	0.00
4mmCharcoalCONC	wg/10liter	0.0000	0.0050	0.0019	0.0011	0.0000	0.0000	0.0033	0.0000

		KIN15D2348s38	**KIN16D2416s37**	**KIN17A1878s165**	**KIN12A249s256**	**KIN12A250s267**	**KIN12A281s300**	**KIN12A291s313**	**KIN18A1379s31**
	Period	KH-P III	KH-P III	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
	Trench	D	D	A1	A2	A2	A2	A2	A2
	Phase	D.4a	D.4a	A1.4	A2.4a	A2.4a	A2.4a	A2.4a	A2.4a
	Context type	pyro	fire layer	pit fill	layer (acc.)	layer (acc.)	layer (acc.)	surface	pyro
	Context class	short-term	short-term	long-term	long-term	long-term	long-term	short-term	short-term
	Soil (ml)	20000	11000	8000	3000	6000	2000	12000	27000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	1
Pinus nigra -type (Scots or black pine)	count	2	—	—	—	—	—	—	2
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	1	—	1	—
Riparian vegetation									
Salicaceae (willow family)	count	—	—	1	—	—	—	3	8
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	1	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	1
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	2	5	12	2	3	2	9	57
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	1	1
Ostrya carpinifolia (hop-hornbeam)	count	—	2	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	1	—	7	—	—	1
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	—	—	1	4
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	1	8	—	—	1	—	1
cf *Vitis vinifera (cf grapevine)*	count	—	—	2	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	1	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	1	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	2	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	6	—	—	—	—	1
Indeterminable broadleaf	count	1	—	4	—	5	—	—	3
Indeterminable conifer	count	—	—	—	—	—	—	—	1
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	count	5	10	36	2	17	3	15	81
Total charcoal	weight total	0.12	1.04	1.49	0.04	0.61	0.07	0.65	4.21
4mmCharcoalCONC	wg/10liter	0.0006	0.0095	1.8625	0.1333	1.0167	0.3500	0.5417	1.5593

		KIN18A1377s3	**KIN18A1397s36**	**KIN15C2520s11**	**KIN16C2659s47**	**KIN16C2672s9999**	**KIN17C2805s16**	**KIN17C2814s27**	**KIN17C2825s38**
	Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
	Trench	A2	A2	C3-E	C3-E	C3-E	C3-E	C3-E	C3-E
	Phase	A2.4b	A2.4b	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2
	Context type	layer (acc.)	pyro	pit fill	surface	layer (acc.)	pit fill	pit fill	pit fill
	Context class	long-term	short-term	long-term	short-term	long-term	long-term	long-term	long-term
	Soil (ml)	31000	10000	46000	4250	3250	14500	18000	8000
Conifers									
Abies sp. (fir)	count	—	—	1	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	6	—	5	1	—	4
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	1	—	—	—	—	—
Juniperus sp. (juniper)	count	5	—	—	—	—	5	3	2
Riparian vegetation									
Salicaceae (willow family)	count	28	12	3	—	—	10	8	31
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	1
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	79	17	27	10	4	15	8	29
Hippophae rhamnoides (seaberry)	count	2	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	1	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	1	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	1	1	—	—	—	2	—	2
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	4	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	1	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	1	—	4	2	—	—	—	1
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	1	—	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	1	1	—	—	—	1	—	—
Indeterminable broadleaf	count	4	—	2	—	—	3	—	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	2	—	—	—	—
Sums									
Analyzed charcoal	count	124	31	49	14	9	37	19	70
Total charcoal	weight total	7.47	1.04	2.26	0.62	0.54	1.96	1.22	4.68
4mmCharcoalCONC	wg/10liter	2.4097	1.0400	0.4913	1.4588	1.6615	1.3517	0.6778	5.8500

		KIN17C2830s40	**KIN17C2853s81**	**KIN17C642s30**	**KIN17C665s63**	**KIN18C2870s13**	**KIN18C2870s15**	**KIN18C2874s5**	**KIN17C2683s13**
	Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
	Trench	C3-E	C3-E	C3-E	C3-E	C3-E	C3-E	C3-E	C3-W
	Phase	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3W.3
	Context type	pit fill	pit fill	surface	pit fill	pit fill	pit fill	surface	layer (acc.)
	Context class	long-term	long-term	short-term	long-term	long-term	long-term	short-term	long-term
	Soil (ml)	13000	17000	9000	15000	39000	38000	18000	15000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	1	—	—	—	4	6	6	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	1	—	—	—
Juniperus sp. (juniper)	count	—	—	—	—	4	3	—	1
Riparian vegetation									
Salicaceae (willow family)	count	3	—	2	—	1	4	1	1
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	15	5	48	9	20	16	3	7
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	2	—	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	1	—	—	—	—	1	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	2	—	—	1	—	1	14	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	2	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—	1	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	1	2	—	—
Indeterminable broadleaf	count	3	—	—	—	1	3	2	1
Indeterminable conifer	count	—	—	—	—	—	1	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	1	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	count	27	6	50	10	32	36	30	10
Total charcoal	weight total	1.58	0.38	6.16	0.61	1.29	1.43	1.03	0.49
4mmCharcoalCONC	wg/10liter	1.2154	0.2235	6.8400	0.4067	0.3308	0.3763	0.5722	0.3267

		KIN17C2811s32	KIN17C2812s22	KIN17C2812s39	KIN17C2833s47	KIN17C2834s51	KIN17C2837s56	KIN17C2838s59	KIN17C2838s61
	Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
	Trench	C3-W	C3-W	C3-W	C3-W	C3-W	C3-W	C3-W	C3-W
	Phase	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	22000	28000	14000	25500	25000	21500	nr	18000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	1	—	1	—	1	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	3	1	1	5	3	2	—	1
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	—	2	2	1	2	4	5	2
Riparian vegetation									
Salicaceae (willow family)	count	3	49	4	19	24	50	86	20
cf Salicaceae (cf willow family)	count	—	—	—	—	—	5	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	1	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	17	27	14	35	23	73	12	40
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	1	—	—	—	1	—	1
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	1
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	1	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	53	—	1	3	4	25	1
cf maloideae (cf apple subfamily)	count	—	—	—	—	1	1	—	—
Pistacia sp. (pistachio)	count	1	—	2	—	—	—	—	—
Amygdalus -type (almond type)	count	—	—	1	1	1	2	—	3
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	2	1	1	—	—	—	1
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	3	2	—	3	—	—	—	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	1	2	—	4	1
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	1	—	1
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	—	—	—	1	3	1	—
Indeterminable broadleaf	count	1	2	1	—	4	2	2	4
Indeterminable conifer	count	—	—	—	—	—	1	—	1
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	5	—	1	1	7	2	6
Sums									
Analyzed charcoal	count	28	145	27	68	67	156	138	83
Total charcoal	weight total	2.71	42.89	2.48	4.12	3.60	14.78	28.42	6.39
4mmCharcoalCONC	wg/10liter	1.2318	15.3179	1.7714	1.6157	1.4400	6.8744	nr	3.5500

		KIN17C2841s67	KIN14A153s32	KIN17A1402s4	KIN17A1406s17	KIN17A1410s34	KIN17A164s26	KIN17A164s55	KIN15C2524s15
	Period	KH-P IV	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA
	Trench	C3-W	Aw	Aw	Aw	Aw	Aw	Aw	C3-E
	Phase	C3W.3	Aw.6	Aw.7	Aw.7	Aw.7	Aw.7	Aw.7	C3E.3
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	22000	22150	26500	20000	12000	21000	21000	15000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	2	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	1	1	1	1	15	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	1	7	1	3	4	—	5	—
Riparian vegetation									
Salicaceae (willow family)	count	9	—	—	9	3	1	7	1
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	1	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	8	3	—	—	—	1	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	16	46	13	29	12	16	56	14
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	9	1	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	3	—	—	—	—	1	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	1	—	—	1	4	—	3	1
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	—	3	2	3	—	—	2	—
Amygdalus -type (almond type)	count	2	2	—	—	—	1	—	—
Prunus -type (plums type)	count	—	—	1	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	4	—	1	—	—	1	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	—	—	—	—	1	2	1
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	3	—	—	2	—	1	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	1	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	2	1	—	1	—
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	—	6	—	1	—	—	1	1
Indeterminable broadleaf	count	1	1	2	1	1	1	5	1
Indeterminable conifer	count	—	—	—	—	—	—	3	1
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	—	—	2	—
Sums									
Analyzed charcoal	count	41	85	22	53	26	23	106	20
Total charcoal	weight total	2.46	7.56	1.35	2.73	1.32	0.94	8.99	0.99
4mmCharcoalCONC	wg/10liter	1.1182	3.4131	0.5094	1.3650	1.1000	0.4476	4.2810	0.6600

		KIN18C2524s23	KIN17C2845s73	KIN17C2851s76	KIN17C2536sNR	KIN18C2526s28	KIN18C2536s29	KIN18C2890s30	KIN18C2892s31
	Period	KH-P VA	KH-P VA	KH-P VA	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VB
	Trench	C3-E	C3-W	C3-W	C3-E	C3-E	C3-E	C3-E	C3-E
	Phase	C3E.3	C3W.4	C3W.4	C3E.4	C3E.4	C3E.4	C3E.4	C3E.4
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	fire layer	fire layer
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	short-term	short-term
	Soil (ml)	24000	16000	18000	4000	10000	30000	18000	10000
Conifers									
Abies sp. (fir)	count	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	4	1	4	—	11	3	1	—
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	count	2	3	1	2	2	3	—	—
Riparian vegetation									
Salicaceae (willow family)	count	6	13	1	14	25	52	77	49
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	count	20	20	30	6	18	38	13	—
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—	—	—
Acer spp. (maple)	count	—	1	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	4	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	1	—	—	—	—	—	2	—
Amygdalus -type (almond type)	count	—	—	—	—	—	—	—	—
Prunus -type (plums type)	count	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	count	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	1	5	—	—	—	—	—	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	2	6	4	7	1
Exotic taxa									
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	count	—	—	—	—	—	—	—	—
Indeterminable	count	3	—	2	—	—	—	—	—
Indeterminable broadleaf	count	—	1	—	—	—	—	—	—
Indeterminable conifer	count	—	—	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—	—	—
bark	count	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	count	37	48	38	24	62	100	100	50
Total charcoal	weight total	2.72	1.87	1.60	0.81	1.99	10.13	3.06	56.10
4mmCharcoalCONC	wg/10liter	1.1333	1.1688	0.8889	2.0250	1.9900	3.3767	1.7000	56.1000

		KIN18C2897s35	**KIN18C2898s36**	**KIN18C3402s42**	**KIN18C3403s43**	**KIN18C3410s44**	**KIN18C3411s49**
	Period	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VI	KH-P VI
	Trench	C3-E	C3-E	C3-E	C3-E	C3-E	C3-E
	Phase	C3E.4	C3E.4	C3E.5	C3E.5	C3E.6	C3E.6
	Context type	layer (acc.)	pit fill	layer (acc.)	layer (acc.)	pit fill	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	30000	20000	32000	49000	10000	16000
Conifers							
Abies sp. (fir)	count	4	—	—	—	—	—
Cedrus sp. (cedar)	count	—	—	—	—	—	—
Pinus sp. (pine)	count	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	count	—	—	1	2	—	2
Pinus brutia -type (Turkish or Aleppo pine)	count	—	—	—	1	—	—
Juniperus sp. (juniper)	count	16	3	6	10	4	7
Riparian vegetation							
Salicaceae (willow family)	count	1	1	4	7	3	2
cf Salicaceae (cf willow family)	count	—	—	—	—	—	—
Tamarix sp. (tamarisk)	count	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	count	—	—	—	—	—	—
Ulmaceae (elm family)	count	—	—	—	—	—	—
Celtis sp. (hackberries)	count	—	—	—	—	—	1
cf *Celtis* sp. (cf hackberries)	count	—	—	—	—	—	—
Ulmus sp. (elm)	count	—	—	—	—	1	1
Deciduous forest-scrub							
Quercus spp. deciduous (deciduous oaks)	count	19	25	59	77	19	39
Hippophae rhamnoides (seaberry)	count	—	—	—	—	—	—
Acer spp. (maple)	count	—	—	—	—	—	1
Ostrya carpinifolia (hop-hornbeam)	count	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	count	—	—	—	—	—	—
Fraxinus sp. (ash)	count	—	—	1	—	—	—
cf *Fraxinus* sp. (cf ash)	count	—	—	—	—	—	—
Economic trees							
Fraxinus ang. /ornus (narrow-l. or manna ash)	count	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	count	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	count	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	count	—	—	—	—	—	—
Juglans regia (walnut)	count	—	—	—	—	—	—
Morus sp. (mulberry)	count	—	—	—	—	—	—
Maloideae (apple subfamily)	count	—	—	—	—	—	1
cf maloideae (cf apple subfamily)	count	—	—	—	—	—	—
Pistacia sp. (pistachio)	count	1	1	2	1	—	—
Amygdalus -type (almond type)	count	—	—	—	—	—	1
Prunus -type (plums type)	count	—	—	2	1	—	—
Amygdalus/Prunus (almond/plums type)	count	1	—	1	—	—	4
cf *Prunus-type* (cf plums-type)	count	—	—	—	—	—	—
Vitis vinifera (grapevine)	count	—	—	—	—	—	—
cf *Vitis vinifera (cf grapevine)*	count	—	—	—	—	—	—
Shrubs							
Asteraceae-type (Aster family type)	count	—	—	—	—	—	—
Euphorbia sp. (spurges)	count	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	count	—	—	—	—	—	—
Monocotyledonae (monocots)	count	—	—	—	—	—	—
Exotic taxa							
Buxus sempervirens (boxwood)	count	—	—	—	—	—	—
Indeterminable charcoals							
Unknown taxa	count	—	1	—	—	—	—
Indeterminable	count	3	—	1	—	1	2
Indeterminable broadleaf	count	—	1	1	1	—	—
Indeterminable conifer	count	—	—	—	—	—	—
root broadleaf	count	—	—	—	—	—	—
bark	count	—	—	—	—	1	2
Sums							
Analyzed charcoal	count	45	32	78	100	29	63
Total charcoal	weight total	2.49	1.13	6.14	11.30	1.14	2.46
4mmCharcoalCONC	wg/10liter	0.8300	0.5650	1.9188	2.3061	1.1400	1.6000

		KIN16B2169s11	**KIN16B502s13**	**KIN12B488s18**	**KIN12B727s417**	**KIN13B638s60**	**KIN13B644s67**	**KIN14B855s4**	**KIN14B860S15**
	Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
	Trench	B	B	B	B	B	B	B	B
	Phase	B.1-2	B.1-2	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a
	Context type	layer (acc.)	debris	pyro	debris	pit fill	pit fill	layer (acc.)	surface
	Context class	long-term	short-term	short-term	short-term	long-term	long-term	long-term	short-term
	Soil (ml)	16250	6200	3500	3500	6000	16000	9250	10000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	—	—	—	0.03	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	0.02	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.24	—	0.01	—	0.11	0.01	—	0.03
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	0.04	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.86	0.2	0.36	—	—	—	0.04	0.15
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	0.08	0.12	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	0.02	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	0.02	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	0.05
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	0.02	0.05	—	0.07
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	0.05	—	—	—	0.05	—	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	0.65	10.82	—	—	0.04	—
Prunus -type (plums type)	weight	0.02	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	0.14	0.03	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.74	—	—	—	—	0.04	—	—
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	0.05	—	—	—	0.04	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	0.08	0.05	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	—	—	—	—
Indeterminable broadleaf	weight	—	0.03	—	—	0.01	0.03	—	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	2.18	0.42	1.02	10.82	0.37	0.19	0.10	0.30
Total charcoal	weight total	2.18	0.42	1.02	85.73	0.37	0.19	0.10	0.30
4mmCharcoalCONC	wg/10liter	0.0134	0.0068	0.0291	2.4494	0.0062	0.0012	0.0011	0.0030

		KIN14B865s17	**KIN14B870s23**	**KIN12B522s96**	**KIN12B562s158**	**KIN12B563s160**	**KIN12B520s93**	**KIN12B540s130**	**KIN13B617s26**
	Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
	Trench	B	B	B	B	B	B	B	B
	Phase	B.1a	B.1a	B.1a-b	B.1a-b	B.1a-b	B.1b	B.1b	B.1b
	Context type	layer (acc.)	pyro	pit fill	pit fill	pit fill	surface	pit fill	layer (acc.)
	Context class	long-term	short-term	long-term	long-term	long-term	short-term	long-term	long-term
	Soil (ml)	9500	7800	10000	10000	1000	10000	10000	10000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	0.03	0.01	—	—	—	—	—	0.52
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	0.2
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.13	—	0.2	—	0.23	—	0.02	0.41
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	0.02	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.54	0.18	—	—	0.18	0.02	0.41	—
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	0.05	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	0.08	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	0.03	—	—	—	0.01	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	0.02	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	0.06	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	0.06	—	—
Amygdalus -type (almond type)	weight	—	0.36	—	—	—	—	—	0.1
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	0.02	0.37	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	0.27	—	—	—	—	0.03	0.11
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	0.12	—	—	—	—	0.14
Euphorbia sp. (spurges)	weight	—	—	0.01	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	0.03	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	—	—	0.06	—
Indeterminable broadleaf	weight	—	—	—	—	—	—	0.04	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	0.03
root broadleaf	weight	—	0.01	—	—	—	—	—	—
bark	weight	—	—	0.05	—	—	—	—	0.05
Sums									
Analyzed charcoal	weight analyzed	0.78	1.23	0.48	0.03	0.46	0.11	0.56	1.56
Total charcoal	weight total	0.78	1.23	0.48	0.03	0.46	0.11	0.56	1.56
4mmCharcoalCONC	wg/10liter	0.0082	0.0158	0.0048	0.0003	0.0460	0.0011	0.0056	0.0156

		KIN14B856s3	KIN12B534s123	KIN13B608s39	KIN13B633s45	KIN13B636s53	KIN13B762s122	KIN13B789s155	KIN14B895s78
	Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
	Trench	B	B	B	B	B	B	B	B
	Phase	B.1b	B.2	B.2	B.2	B.2	B.2	B.2	B.2
	Context type	layer (acc.)	surface	pit fill	pit fill	layer (acc.)	pit fill	layer (acc.)	pithos fill
	Context class	long-term	short-term	long-term	long-term	long-term	long-term	long-term	short-term
	Soil (ml)	6500	10000	10000	7500	9000	14500	15000	10000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	—	0.11	—	0.02	0.07	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.11	0.05	—	0.79	—	0.02	0.02	—
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.03	1.16	0.77	—	0.12	0.16	0.24	0.12
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	0.05	—	0.01	0.06	0.07	—	0.09	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	0.02	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	0.19	—	—
Maloideae (apple subfamily)	weight	0.14	0.12	—	—	0.06	—	0.04	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	0.46	0.07	—	0.95	—	—	0.06	0.06
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	0.03	0.01	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	0.02	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.07	0.15	0.13	0.03	—	0.27	0.04	0.05
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	0.02	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	0.06	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	0.03	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	0.06	—	—	—	—	—	—
Indeterminable broadleaf	weight	—	—	0.03	—	—	0.08	0.01	—
Indeterminable conifer	weight	—	0.02	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	0.03	—	—	—	0.17
Sums									
Analyzed charcoal	weight analyzed	0.86	1.63	1.02	2.02	0.26	0.77	0.59	0.40
Total charcoal	weight total	0.86	1.63	1.02	2.02	0.26	0.77	0.59	0.40
4mmCharcoalCONC	wg/10liter	0.0132	0.0163	0.0102	0.0269	0.0029	0.0053	0.0039	0.0040

		KIN15B2082s42	KIN13A146s61	KIN14A131s138	KIN17A1830s12	KIN18A1974s70	KIN18A1987s73	KIN14A1502s44	KIN14A1512s48
	Period	KH-P I	KH-P IIA	KH-P IIA	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	B	A1	A1	A1	A1	A1	A1	A1
	Phase	B.2	A1.1a	A1.1a	A1.1	A1.1	A1.1	A1.1a/b	A1.1b
	Context type	pit fill	surface	debris	pit fill	layer (acc.)	layer (acc.)	layer (acc.)	pyro
	Context class	long-term	short-term	short-term	long-term	long-term	long-term	long-term	short-term
	Soil (ml)	26500	10000	9000	8000	20000	18000	7150	3800
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	0.04	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	0.07	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.04	0.05	—	—	0.48	—	0.04	—
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	0.02	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	—	0.93	—	—	9.05	6.57	0.35	0.05
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	0.08	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	0.95	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	0.06	0.23	0.12	0.15
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	0.03	—	0.07
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	0.16	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	0.05	—	—	0.43	0.19	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	0.12	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	0.1	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	0.1	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.12	0.73	—	0.13	1.7	0.17	0.04	—
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	0.02	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	0.06	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	0.13	—	—	—
Indeterminable broadleaf	weight	0.07	0.01	—	—	0.32	—	—	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	0.13	—	—	—
Sums									
Analyzed charcoal	weight analyzed	0.63	2.88	0.00	0.13	12.45	7.25	0.57	0.27
Total charcoal	weight total	0.63	2.88	0.00	0.13	12.45	23.46	0.57	0.27
4mmCharcoalCONC	wg/10liter	0.0024	2.8800	0.0000	0.1625	6.2250	13.0333	0.7972	0.7105

		KIN14A1534s101	**KIN14A1540s98**	**KIN15A1539S77**	**KIN15A1607S11**	**KIN12A233s261**	**KIN12A233s273**	**KIN12A237s238**	**KIN13A939s257**
	Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	A1	A1	A1	A1	A2	A2	A2	A2
	Phase	A1.1c	A1.1c	A1.1c	A1.1c	A2.2	A2.2	A2.2	A2.2
	Context type	surface	pyro	layer (acc.)	layer (acc.)	pit fill	pit fill	other fill	pit fill
	Context class	short-term	short-term	long-term	long-term	long-term	long-term	short-term	long-term
	Soil (ml)	10450	650	8500	7750	2000	8000	3000	13000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.02	0.03	0.07	—	—	—	0.05	0.02
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	0.15	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.4	—	5.1	4.89	0.02	0.04	0.81	0.06
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	0.11	—	0.07	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	0.15	—	0.02	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	0.68	—	0.73	—	—	—	0.18	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.06	14.8	0.08	—	—	—	0.17	—
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	0.05	—	—	—	—	0.11
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	0.49	—	—	—	—	—
Indeterminable broadleaf	weight	0.15	0.03	0.03	—	—	—	0.06	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	0.08	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	1.57	14.86	6.79	4.97	0.02	0.04	1.27	0.19
Total charcoal	weight total	1.57	56.31	6.79	19.21	0.02	0.04	1.27	0.19
4mmCharcoalCONC	wg/10liter	1.5024	866.3077	7.9882	24.7871	0.1000	0.0500	4.2333	0.1462

		KIN13A950s242	KIN13A967s266	KIN13A972s304	KIN13A982s293	KIN14B803s113	KIN12B560s156	KIN15B2109s93	KIN16B2221s119
	Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	A2	A2	A2	A2	B	B	B	B
	Phase	A2.2	A2.2	A2.2	A2.2	B.3a	B.3b/4a	B.3b/4a	B.3b/4a
	Context type	pit fill	layer (acc.)	pit fill	pit fill	surface	layer (acc.)	layer (acc.)	surface
	Context class	long-term	long-term	long-term	long-term	short-term	long-term	long-term	short-term
	Soil (ml)	14000	11000	19000	16000	90	10000	16000	16500
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	0.04	—	0.04	0.02	0.02	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	0.02	—	0.04	0.07	—	—	—	—
Juniperus sp. (juniper)	weight	—	0.08	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.11	0.05	—	0.2	—	—	0.19	—
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	0.09	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	0.02	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.16	0.44	0.06	0.24	—	1.06	—	0.75
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	0.03	—	—	—	—	0.22	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	0.04	—	—	0.05	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	1.76	—	—	—	—	—	0.15
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	0.03	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	1.47	—	—	0.03	0.04	3.63	0.48
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	0.04	0.05	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	0.03	—	—	—
Indeterminable broadleaf	weight	—	0.29	0.11	—	—	—	—	0.02
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	0.34	5.29	0.31	0.59	0.08	1.12	4.09	1.40
Total charcoal	weight total	0.34	5.29	0.31	0.59	0.08	1.12	10.15	1.40
4mmCharcoalCONC	wg/10liter	0.2429	4.8091	0.1632	0.3688	8.8889	1.1200	6.3438	0.8485

		KIN15B2113s108	KIN15B2111s116	KIN12B549s138	KIN16B2181s34	KIN16B2196s59	KIN13B767s126	KIN14B2018s120	KIN14B2031s133
	Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	B	B	B	B	B	B	B	B
	Phase	B.4	B.4a	B.4a/b	B.4b	B.4b/c	B.4c	B.4c	B.4c
	Context type	pyro	layer (acc.)	surface	layer (acc.)	layer (acc.)	pyro	surface	pithos fill
	Context class	short-term	long-term	short-term	long-term	long-term	short-term	short-term	short-term
	Soil (ml)	6000	3000	nr	7250	17000	20000	nr	27000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	—	—	—	—	—	0.02
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	0.11
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	—	—	0.25	0.05	0.13	—	0.07	0.16
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.13	—	4.49	0.49	3.29	0.97	9.35	0.31
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	0.09	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	0.24	—	—
Elaeagnus angustifolia (Russian olive)	weight	0.02	—	—	0.06	—	—	—	0.1
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	0.02	—	0.11	—	—	—	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	0.2	—	—	—	—	—
Prunus -type (plums type)	weight	0.08	—	—	—	—	0.13	0.14	—
Amygdalus/Prunus (almond/plums type)	weight	0.62	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.06	1.36	0.01	—	—	0.01	0.05	0.78
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	0.11	0.01	—	—	0.02	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	0.07	—	—	—	—	—
Indeterminable broadleaf	weight	—	—	0.17	—	0.18	—	—	0.02
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	0.02	—	0.02	—	—	0.02	0.02
Sums									
Analyzed charcoal	weight analyzed	0.93	1.38	5.50	0.63	3.60	1.35	9.65	1.52
Total charcoal	weight total	0.93	1.38	5.50	0.63	3.60	1.35	9.65	1.52
4mmCharcoalCONC	wg/10liter	1.5500	4.6000	nr	0.8690	2.1176	0.6750	nr	0.5630

		KIN14B2032s135_a	KIN14B2032s135_b	KIN14B2032s140	KIN14B845s132	KIN15B2091s57	KIN15B2098s77	KIN15B2107s86	KIN13D1044s25
	Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
	Trench	B	B	B	B	B	B	B	D
	Phase	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	D.2a
	Context type	pyro	pyro	pyro	pithos fill	layer (acc.)	pithos fill	layer (acc.)	pit fill
	Context class	short-term	short-term	short-term	short-term	long-term	short-term	long-term	long-term
	Soil (ml)	4500	4000	4500	3150	3000	20250	10000	900
Conifers									
Abies sp. (fir)	weight	0.04	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	0.43	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	0.36	—	0.06	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	0.41	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.48	—	—	—	—	—	0.01	—
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.02	0.18	0.49	0.42	0.8	0.09	0.03	—
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	0.18	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	0.23	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	0.3	0.04	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	0.48	0.01	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	8.19	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	0.03	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	—	—	0.29	0.07	0.03	—	—
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	—	0.2	0.11	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	0.01	0.03	—	0.04	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	—	—	—	—
Indeterminable broadleaf	weight	0.1	—	—	0.03	—	—	—	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	10.87	0.82	0.60	0.84	0.87	0.15	0.04	0.00
Total charcoal	weight total	10.87	0.82	0.60	0.84	0.87	0.15	0.04	0.00
4mmCharcoalCONC	wg/10liter	24.1556	2.0500	1.3333	2.6667	2.9000	0.0741	0.0400	0.0000

		KIN13D1070s71	KIN13D1041s23	KIN13A175s117	KIN15A1668s85	KIN15A1676s93	KIN15A1685s131	KIN16A1683s4	KIN16A1685s52
	Period	KH-P IIB	KH-P IIB	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	D	D	A1	A1	A1	A1	A1	A1
	Phase	D.2a	D.2a/b	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a
	Context type	pyro	pit fill	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)
	Context class	short-term	long-term	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	12000	3000	10000	8000	6500	11000	20750	18000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	0.01	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	0.05	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	—	—	0.3	—	—	—	0.14	0.04
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	0.04	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	0.33	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	0.24	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	—	0.17	2.68	6.97	5.1	4.97	15.09	9.06
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	0.02
Acer spp. (maple)	weight	—	—	—	—	—	—	0.14	0.12
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight			—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	0.06	—	—	0.03	0.42	0.11
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	0.08	—	0.07	—	—	0.02
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	0.08	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	0.28	1.95	0.07	0.13	2.05	0.83
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	0.06
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	0.39
Prunus -type (plums type)	weight	—	—	0.03	0.37	0.19	—	0.37	0.41
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	0.04	0.06	—	0.05
cf *Prunus-type* (cf plums-type)	weight	—	—	—	0.02	—	—	—	—
Vitis vinifera (grapevine)	weight	1.31	—	0.84	7.6	0.41	0.15	3.83	1.69
cf *Vitis vinifera (cf grapevine)*	weight			—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	0.06	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	0.05	2.77	0.16	0.09	—	0.24
Indeterminable broadleaf	weight	—	0.07	0.54	0.06	0.45	0.24	0.3	0.63
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	1.2	0.22	—	0.06	0.11
Sums									
Analyzed charcoal	weight analyzed	1.36	0.24	4.94	21.27	7.05	5.67	22.41	13.78
Total charcoal	weight total	1.36	0.24	4.94	44.93	7.05	5.67	45.58	14.41
4mmCharcoalCONC	wg/10liter	1.1333	0.8000	0.0494	0.5616	0.1085	0.0515	0.2197	0.0801

		KIN16A1689s26	KIN16A1711s67	KIN16A1721s55	KIN16A1732s70	KIN16A1745s95	KIN18A1996s91	KIN18A3610s123	KIN17A1771s64
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	A1	A1	A1	A1	A1	A1	A1	A1
	Phase	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2b
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	pyro	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	short-term	long-term
	Soil (ml)	17000	18250	10750	6200	13750	28000	18000	28000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	0.07	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	0.04	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.14	0.03	—	—	0.72	—	0.09	—
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	3.43	4.9	6.58	2.8	1.59	10.28	11.28	0.63
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	0.3	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	0.07	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight	0.05	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	2.69	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	0.04	0.07	—	—	—	—	0.02	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	0.03	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	0.07	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	0.57	1.1	0.68	0.03	0.02	0.22	0.29	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	0.08	—	—	—	—	0.51	—	—
Prunus -type (plums type)	weight	0.14	0.08	0.07	0.04	—	0.17	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	0.03	—	—	—
Vitis vinifera (grapevine)	weight	1.2	1.69	2.04	0.4	1.24	0.09	—	—
cf *Vitis vinifera (cf grapevine)*	weight	0.03	0.08	0.07	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	0.02	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	0.1	—	—	—
Monocotyledonae (monocots)	weight	—	—	0.04	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	0.1	0.19	0.16	—	—	—	—	—
Indeterminable broadleaf	weight	0.4	0.05	1.05	0.15	0.28	—	—	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	0.02	0.23	0.19	0.27	0.01	0.15	0.17	0.02
Sums									
Analyzed charcoal	weight analyzed	8.92	8.56	10.88	3.69	4.01	11.42	12.26	0.65
Total charcoal	weight total	8.92	8.56	10.88	3.69	4.01	32.84	nr	0.65
4mmCharcoalCONC	wg/10liter	0.0525	0.0469	0.1012	0.0595	0.0292	11.7286	nr	0.0023

		KIN17A1771s65	KIN17A1771s66	KIN17A1771s67	KIN18A1902s4	KIN17A1790s135	KIN17A1893s149	KIN17A1894s157	KIN17A1894s158
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	A1	A1	A1	A1	A1	A1	A1	A1
	Phase	A1.2b	A1.2b	A1.2b	A1.2b	A1.3	A1.3	A1.3	A1.3
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	30000	10000	20000	18000	20000	20000	30000	10000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	0.02	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	0.04	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	0.08	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	—	—	—	0.05	0.21	0.39	0.21	—
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	0.12	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	0.02	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.23	—	0.13	1	1.07	2.61	2.08	—
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	0.36	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	0.08	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	0.02	—	0.05	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	0.04	0.08	0.07	—	0.11	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	0.06	0.02	0.04	—	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	0.15	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	0.06	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	—	—	0.33	0.34	0.19	0.03	—
cf *Vitis vinifera (cf grapevine)*	weight	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	0.05	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	0.03	0.04	0.07	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	0.05	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	0.03	—	—	—
Indeterminable	weight	—	—	—	—	—	0.05	0.07	—
Indeterminable broadleaf	weight	—	—	—	—	0.03	0.1	0.09	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	0.04	—	—	—	—	0.02	—	—
Sums									
Analyzed charcoal	weight analyzed	0.31	0.00	0.17	1.64	2.03	3.90	2.91	0.00
Total charcoal	weight total	0.31	0.00	0.17	1.64	2.03	3.90	2.91	0.00
4mmCharcoalCONC	wg/10liter	0.0010	0.0000	0.0009	0.0091	0.0102	0.0195	0.0097	0.0000

		KIN12A231s258	KIN12A231s260	KIN13B790s152	KIN14B899s91	KIN13B802s162	KIN13B804s167	KIN14B2002s105	KIN14B2002s106_a
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	A2	A2	B	B	B	B	B	B
	Phase	A2.3	A2.3	B.5	B.5b-6a	B.6	B.6	B.6b	B.6b
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	pyro	pyro
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	short-term	short-term
	Soil (ml)	3500	9500	10000	10000	10000	10000	1000	10000
Conifers									
Abies sp. (fir)	weight	—	—	—	0.06	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	0.02	—	—	0.09	—	0.01
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	0.03	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	—	—	0.08	0.18	0.04	0.04	—	0.14
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	0.03	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	—	0.06	0.58	1.08	1.73	1.62	0.16	0.75
Hippophae rhamnoides (seaberry)	weight	—	0.04	—	—	—	0.2	—	0.41
Acer spp. (maple)	weight	—	—	—	—	—	0.02	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	0.03	—	—	0.05	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	0.12	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	—	0.02	—	—	—	—
Prunus -type (plums type)	weight	—	—	0.05	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	0.02	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	0.19	—	0.21	0.03	—	—	0.06
cf *Vitis vinifera (cf grapevine)*	weight	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	0.12	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	0.04	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	—	—	—	—
Indeterminable broadleaf	weight	—	0.01	—	0.09	0.06	0.09	—	0.08
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	0.03	0.12	—	0.02	—	0.03
Sums									
Analyzed charcoal	weight analyzed	0.00	0.30	1.08	1.76	1.89	2.17	0.16	1.48
Total charcoal	weight total	0.00	0.30	1.08	1.76	1.89	2.17	0.16	1.48
4mmCharcoalCONC	wg/10liter	0.0000	0.0032	0.0108	0.0176	0.0189	0.0217	0.0160	0.0148

		KIN14B2002s106_b	KIN13B807s175	KIN14B807s125	KIN14B807s38_a	KIN14B807s38_b	KIN14B817s33	KIN14B876s115	KIN15D2379s117
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	B	B	B	B	B	B	B	D
	Phase	B.6b	B.7	B.7	B.7	B.7	B.7	B.7	D.3
	Context type	pyro	bin fill	bin fill	bin fill	bin fill	debris	surface	layer (acc.)
	Context class	short-term	long-term	long-term	long-term	long-term	short-term	short-term	long-term
	Soil (ml)	6000	14000	8500	3000	3000	9000	7500	15500
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	—	—	—	0.07	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	0.02	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	0.04	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.03	1.08	0.21	0.05	0.06	0.04	—	0.1
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	0.15	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.12	1.45	0.97	0.65	0.07	0.54	1.07	0.69
Hippophae rhamnoides (seaberry)	weight	0.16	—	—	—	—	0.03	0.34	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	0.04	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	0.09
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	0.32	—	0.18	0.04	0.05	0.18	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	0.14	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	0.14	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	0.09	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.2	0.09	0.4	0.24	—	0.03	0.03	0.13
cf *Vitis vinifera (cf grapevine)*	weight	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	0.16	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	0.02	0.03	0.03	—	—
Monocotyledonae (monocots)	weight	—	0.02	0.01	—	0.02	0.02	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	0.23	—	—	—
Indeterminable broadleaf	weight	0.02	0.01	0.09	0.08	—	0.02	0.02	0.14
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	0.02	—	—	0.08	—	0.08	0.02	0.03
Sums									
Analyzed charcoal	weight analyzed	1.10	2.83	2.23	1.16	0.46	1.04	1.48	1.18
Total charcoal	weight total	1.10	2.83	2.23	1.16	0.46	1.04	1.48	1.18
4mmCharcoalCONC	wg/10liter	0.0183	0.0202	0.0262	0.0387	0.0153	0.0116	0.0197	0.0076

		KIN13D1073s67	KIN13D1144s185	KIN14D1124s4	KIN14D1149s73	KIN14D1155s20	KIN14D1109s95	KIN14D1166s138	KIN14D1166s52_a
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	D	D	D	D	D	D	D	D
	Phase	D.3a	D.3a	D.3a	D.3a	D.3a	D.3b	D.3b	D.3b
	Context type	layer (acc.)	layer (acc.)	surface	surface	layer (acc.)	surface	pyro	pyro
	Context class	long-term	long-term	short-term	short-term	long-term	short-term	short-term	short-term
	Soil (ml)	2500	4800	4500	2500	9500	1500	9000	3600
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	—	—	—	—	—	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	0.02	—
Riparian vegetation									
Salicaceae (willow family)	weight	—	—	—	—	0.06	—	0.03	—
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	0.01	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	—	0.04	—	0.16	0.06	—	1.21	—
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	0.07	—	—	—	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	0.04
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	0.03	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	—	—	0.04	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	—	0.04	—	0.48	—	0.05	—
cf *Vitis vinifera (cf grapevine)*	weight	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	0.1	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	0.07	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	0.04	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	0.03	—	—	—	—	—
Indeterminable broadleaf	weight	—	—	—	—	0.1	—	0.05	0.13
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	0.00	0.04	0.14	0.20	0.77	0.00	1.54	0.17
Total charcoal	weight total	0.00	0.04	0.14	0.20	0.77	0.00	1.54	0.17
4mmCharcoalCONC	wg/10liter	0.0000	0.0008	0.0031	0.0080	0.0081	0.0000	0.0171	0.0047

		KIN14D1166s52_b	KIN14D2302s102	KIN14D2314s140	KIN15D2376s140	KIN14D1192s101	KIN14D1192s88	KIN15D2385s150	KIN15D2313s74
	Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
	Trench	D	D	D	D	D	D	D	D
	Phase	D.3b	D.3b	D.3b	D.3b	D.3c	D.3c	D.3c	D.4a
	Context type	pyro	pyro	surface	pit fill	pyro	pyro	surface	pyro
	Context class	short-term	short-term	short-term	long-term	short-term	short-term	short-term	short-term
	Soil (ml)	2600	10000	8000	17500	3000	9000	12000	7500
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	—	—	—	—	0.01	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	—	—	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	—	—	—	—	—	—	—	—
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	—	0.36	0.05	0.11	—	—	0.08	—
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight	—	—	—	—	—	—	—	—
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	—	—	0.05	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	0.14	0.06	0.09	—	—	0.04	—
cf *Vitis vinifera (cf grapevine)*	weight	—	—	—	—	—	—	0.02	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	0.13	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—	0.04	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	—	—	—	—
Indeterminable broadleaf	weight	—	—	0.04	—	—	—	0.03	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	0.00	0.50	0.15	0.20	0.00	0.00	0.40	0.00
Total charcoal	weight total	0.00	0.50	0.15	0.20	0.00	0.00	0.40	0.00
4mmCharcoalCONC	wg/10liter	0.0000	0.0050	0.0019	0.0011	0.0000	0.0000	0.0033	0.0000

		KIN15D2348s38	**KIN16D2416s37**	**KIN17A1878s165**	**KIN12A249s256**	**KIN12A250s267**	**KIN12A281s300**	**KIN12A291s313**	**KIN18A1379s31**
	Period	KH-P III	KH-P III	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
	Trench	D	D	A1	A2	A2	A2	A2	A2
	Phase	D.4a	D.4a	A1.4	A2.4a	A2.4a	A2.4a	A2.4a	A2.4a
	Context type	pyro	fire layer	pit fill	layer (acc.)	layer (acc.)	layer (acc.)	surface	pyro
	Context class	short-term	short-term	long-term	long-term	long-term	long-term	short-term	short-term
	Soil (ml)	20000	11000	8000	3000	6000	2000	12000	27000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	0.11
Pinus nigra -type (Scots or black pine)	weight	0.06	—	—	—	—	—	—	0.08
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	0.03	—	0.02	—
Riparian vegetation									
Salicaceae (willow family)	weight	—	—	0.01	—	—	—	0.04	0.16
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	0.01	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	0.03
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.05	0.46	0.41	0.04	0.05	0.06	0.52	3.17
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	0.06	0.03
Ostrya carpinifolia (hop-hornbeam)	weight	—	0.28	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight	—	—						
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	0.06	—	0.31	—	—	0.05
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	—	—	0.01	0.37
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	0.04	0.47	—	—	0.01	—	0.09
cf *Vitis vinifera (cf grapevine)*	weight	—	—	0.12	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	0.11	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	0.11	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	0.26	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	0.15	—	—	—	—	0.02
Indeterminable broadleaf	weight	0.01	—	0.15	—	0.11	—	—	0.08
Indeterminable conifer	weight	—	—	—	—	—	—	—	0.02
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	0.12	1.04	1.49	0.04	0.61	0.07	0.65	4.21
Total charcoal	weight total	0.12	1.04	1.49	0.04	0.61	0.07	0.65	4.21
4mmCharcoalCONC	wg/10liter	0.0006	0.0095	1.8625	0.1333	1.0167	0.3500	0.5417	1.5593

		KIN18A1377s3	KIN18A1397s36	KIN15C2520s11	KIN16C2659s47	KIN16C2672s9999	KIN17C2805s16	KIN17C2814s27	KIN17C2825s38
	Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
	Trench	A2	A2	C3-E	C3-E	C3-E	C3-E	C3-E	C3-E
	Phase	A2.4b	A2.4b	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2
	Context type	layer (acc.)	pyro	pit fill	surface	layer (acc.)	pit fill	pit fill	pit fill
	Context class	long-term	short-term	long-term	short-term	long-term	long-term	long-term	long-term
	Soil (ml)	31000	10000	46000	4250	3250	14500	18000	8000
Conifers									
Abies sp. (fir)	weight	—	—	0.03	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	0.17	—	0.25	0.15	—	0.09
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	0.02	—	—	—	—	—
Juniperus sp. (juniper)	weight	0.28	—	—	—	—	0.16	0.52	0.24
Riparian vegetation									
Salicaceae (willow family)	weight	1.19	0.28	0.11	—	—	0.44	0.35	2.3
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	0.04
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	5.51	0.68	1.35	0.49	0.29	0.9	0.35	1.74
Hippophae rhamnoides (seaberry)	weight	0.13	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	0.03	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	0.06	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	0.03	0.04	—	—	—	0.09	—	0.17
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	0.35	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	0.05	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.02	—	0.12	0.1	—	—	—	0.1
cf *Vitis vinifera (cf grapevine)*	weight	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	0.06	—	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	—	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	0.04	0.04	—	—	—	0.06	—	—
Indeterminable broadleaf	weight	0.1	—	0.08	—	—	0.16	—	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	0.03	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	7.47	1.04	2.26	0.62	0.54	1.96	1.22	4.68
Total charcoal	weight total	7.47	1.04	2.26	0.62	0.54	1.96	1.22	4.68
4mmCharcoalCONC	wg/10liter	2.4097	1.0400	0.4913	1.4588	1.6615	1.3517	0.6778	5.8500

		KIN17C2830s40	KIN17C2853s81	KIN17C642s30	KIN17C665s63	KIN18C2870s13	KIN18C2870s15	KIN18C2874s5	KIN17C2683s13
	Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
	Trench	C3-E	C3-E	C3-E	C3-E	C3-E	C3-E	C3-E	C3-W
	Phase	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3W.3
	Context type	pit fill	pit fill	surface	pit fill	pit fill	pit fill	surface	layer (acc.)
	Context class	long-term	long-term	short-term	long-term	long-term	long-term	short-term	long-term
	Soil (ml)	13000	17000	9000	15000	39000	38000	18000	15000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	0.02	—	—	—	0.06	0.42	0.13	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	0.02	—	—	—
Juniperus sp. (juniper)	weight	—	—	—	—	0.15	0.12	—	0.05
Riparian vegetation									
Salicaceae (willow family)	weight	0.08	—	0.06	—	0.03	0.12	0.06	0.02
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	0.81	0.27	4.18	0.56	0.97	0.57	0.21	0.39
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	0.11	—	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	—	—	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	0.11	—	—	—	—	0.08	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.22	—	—	0.05	—	0.03	0.45	—
cf *Vitis vinifera (cf grapevine)*	weight	—	—	—	—	—	—	0.04	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—	0.02	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	0.02	0.05	—	—
Indeterminable broadleaf	weight	0.32	—	—	—	0.04	0.1	0.04	0.03
Indeterminable conifer	weight	—	—	—	—	—	0.02	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	0.02	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	1.58	0.38	4.24	0.61	1.29	1.43	1.03	0.49
Total charcoal	weight total	1.58	0.38	6.16	0.61	1.29	1.43	1.03	0.49
4mmCharcoalCONC	wg/10liter	1.2154	0.2235	6.8400	0.4067	0.3308	0.3763	0.5722	0.3267

		KIN17C2811s32	**KIN17C2812s22**	**KIN17C2812s39**	**KIN17C2833s47**	**KIN17C2834s51**	**KIN17C2837s56**	**KIN17C2838s59**	**KIN17C2838s61**
	Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
	Trench	C3-W	C3-W	C3-W	C3-W	C3-W	C3-W	C3-W	C3-W
	Phase	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	22000	28000	14000	25500	25000	21500	nr	18000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	0.15	—	0.03	—	0.03	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	0.06	0.01	0.03	0.12	0.06	0.08	—	0.07
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	—	0.07	0.06	0.03	0.14	0.17	4.52	0.05
Riparian vegetation									
Salicaceae (willow family)	weight	0.09	3.58	0.2	1.6	1.09	3.02	8.95	0.79
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	0.2	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	0.07	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	2.38	13.91	1.54	1.86	1.31	9.7	11.5	3.84
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	0.11	—	—	—	0.09	—	0.03
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	0.01
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	0.04	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	24.69	—	0.05	0.48	0.15	2.19	0.38
cf maloideae (cf apple subfamily)	weight	—	—	—	—	0.02	0.12	—	—
Pistacia sp. (pistachio)	weight	0.03	—	0.07	—	—	—	—	—
Amygdalus -type (almond type)	weight	—	—	0.37	0.08	0.04	0.22	—	0.19
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	0.16	0.04	0.03	—	—	—	0.03
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.13	0.07	—	0.27	—	—	—	—
cf *Vitis vinifera (cf grapevine)*	weight	—	—	—	—	—	—	—	—
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	0.03	0.05	—	0.4	0.03
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	0.01	—	0.02
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	—	—	—	0.04	0.23	0.15	—
Indeterminable broadleaf	weight	0.02	0.06	0.02	—	0.25	0.14	0.66	0.51
Indeterminable conifer	weight	—	—	—	—	—	0.04	—	0.03
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	0.19	—	0.05	0.02	0.41	0.02	0.39
Sums									
Analyzed charcoal	weight analyzed	2.71	42.89	2.48	4.12	3.60	14.78	28.42	6.39
Total charcoal	weight total	2.71	42.89	2.48	4.12	3.60	14.78	28.42	6.39
4mmCharcoalCONC	wg/10liter	1.2318	15.3179	1.7714	1.6157	1.4400	6.8744	nr	3.5500

		KIN17C2841s67	KIN14A153s32	KIN17A1402s4	KIN17A1406s17	KIN17A1410s34	KIN17A164s26	KIN17A164s55	KIN15C2524s15
	Period	KH-P IV	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA
	Trench	C3-W	Aw	Aw	Aw	Aw	Aw	Aw	C3-E
	Phase	C3W.3	Aw.6	Aw.7	Aw.7	Aw.7	Aw.7	Aw.7	C3E.3
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	22000	22150	26500	20000	12000	21000	21000	15000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	0.11	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	0.04	0.01	0.01	0.04	0.5	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	0.04	0.52	0.05	0.1	0.51	—	0.54	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.45	—	—	0.33	0.13	0.05	0.32	0.04
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	0.02	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	0.25	0.13	—	—	—	0.01	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	1.12	3.89	0.72	1.93	0.43	0.68	5.86	0.68
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	1.61	0.04	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	0.17	—	—	—	—	0.13	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	0.39	—	—	0.03	0.16	—	0.28	0.16
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	—	0.26	0.19	0.16	—	—	0.31	—
Amygdalus -type (almond type)	weight	0.07	0.25	—	—	—	0.08	—	—
Prunus -type (plums type)	weight	—	—	0.07	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	0.27	—	0.02	—	—	0.04	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	—	—	—	—	0.02	0.14	0.04
cf *Vitis vinifera (cf grapevine)*	weight	—							
Shrubs									
Asteraceae-type (Aster family type)	weight	0.12	—	—	0.05	—	0.03	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	0.03	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	0.02	0.02	—	0.07	—
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	—	0.38	—	0.06	—	—	0.1	0.02
Indeterminable broadleaf	weight	0.02	0.05	0.22	0.02	0.06	0.03	0.31	0.03
Indeterminable conifer	weight	—	—	—	—	—	—	0.21	0.02
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	—	—	0.07	—
Sums									
Analyzed charcoal	weight analyzed	2.46	7.56	1.35	2.73	1.32	0.94	8.99	0.99
Total charcoal	weight total	2.46	7.56	1.35	2.73	1.32	0.94	8.99	0.99
4mmCharcoalCONC	wg/10liter	1.1182	3.4131	0.5094	1.3650	1.1000	0.4476	4.2810	0.6600

		KIN18C2524s23	KIN17C2845s73	KIN17C2851s76	KIN17C2536sNR	KIN18C2526s28	KIN18C2536s29	KIN18C2890s30	KIN18C2892s31
	Period	KH-P VA	KH-P VA	KH-P VA	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VB
	Trench	C3-E	C3-W	C3-W	C3-E	C3-E	C3-E	C3-E	C3-E
	Phase	C3E.3	C3W.4	C3W.4	C3E.4	C3E.4	C3E.4	C3E.4	C3E.4
	Context type	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	layer (acc.)	fire layer	fire layer
	Context class	long-term	long-term	long-term	long-term	long-term	long-term	short-term	short-term
	Soil (ml)	24000	16000	18000	4000	10000	30000	18000	10000
Conifers									
Abies sp. (fir)	weight	—	—	—	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	0.17	0.02	0.09	—	0.49	0.08	0.02	—
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	—	—	—	—	—
Juniperus sp. (juniper)	weight	0.06	0.12	0.03	0.04	0.06	0.29	—	—
Riparian vegetation									
Salicaceae (willow family)	weight	0.2	0.49	0.04	0.58	0.6	2.4	2	6.67
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	—	—	—
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	—	—	—	—
Deciduous forest-scrub									
Quercus spp. deciduous (deciduous oaks)	weight	1.99	0.92	1.38	0.14	0.76	2.89	0.59	—
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—	—	—
Acer spp. (maple)	weight	—	0.03	—	—	—	—	—	—
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	—	—	—	—	—	—
cf *Fraxinus* sp. (cf ash)	weight								
Economic trees									
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	0.15	—	—	—	—	—	—
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	0.03	—	—	—	—	—	0.06	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	—	—	—
Prunus -type (plums type)	weight	—	—	—	—	—	—	—	—
Amygdalus/Prunus (almond/plums type)	weight	—	—	—	—	—	—	—	—
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	0.05	0.12	—	—	—	—	—	—
cf *Vitis vinifera (cf grapevine)*	weight								
Shrubs									
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	0.05	0.08	0.06	0.09	0.01
Exotic taxa									
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—	—	—
Indeterminable charcoals									
Unknown taxa	weight	—	—	—	—	—	—	—	—
Indeterminable	weight	0.22	—	0.06	—	—	—	—	—
Indeterminable broadleaf	weight	—	0.02	—	—	—	—	—	—
Indeterminable conifer	weight	—	—	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—	—	—
bark	weight	—	—	—	—	—	—	—	—
Sums									
Analyzed charcoal	weight analyzed	2.72	1.87	1.60	0.81	1.99	5.72	2.76	6.68
Total charcoal	weight total	2.72	1.87	1.60	0.81	1.99	10.13	3.06	56.10
4mmCharcoalCONC	wg/10liter	1.1333	1.1688	0.8889	2.0250	1.9900	3.3767	1.7000	56.1000

		KIN18C2897s35	**KIN18C2898s36**	**KIN18C3402s42**	**KIN18C3403s43**	**KIN18C3410s44**	**KIN18C3411s49**
	Period	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VI	KH-P VI
	Trench	C3-E	C3-E	C3-E	C3-E	C3-E	C3-E
	Phase	C3E.4	C3E.4	C3E.5	C3E.5	C3E.6	C3E.6
	Context type	layer (acc.)	pit fill	layer (acc.)	layer (acc.)	pit fill	layer (acc.)
	Context class	long-term	long-term	long-term	long-term	long-term	long-term
	Soil (ml)	30000	20000	32000	49000	10000	16000
Conifers							
Abies sp. (fir)	weight	0.24	—	—	—	—	—
Cedrus sp. (cedar)	weight	—	—	—	—	—	—
Pinus sp. (pine)	weight	—	—	—	—	—	—
Pinus nigra -type (Scots or black pine)	weight	—	—	0.03	0.07	—	0.05
Pinus brutia -type (Turkish or Aleppo pine)	weight	—	—	—	0.03	—	—
Juniperus sp. (juniper)	weight	1.17	0.05	0.38	0.34	0.16	0.19
Riparian vegetation							
Salicaceae (willow family)	weight	0.02	0.04	0.14	0.34	0.08	0.03
cf Salicaceae (cf willow family)	weight	—	—	—	—	—	—
Tamarix sp. (tamarisk)	weight	—	—	—	—	—	—
cf *Tamarix* sp. (cf tamarisk)	weight	—	—	—	—	—	—
Ulmaceae (elm family)	weight	—	—	—	—	—	—
Celtis sp. (hackberries)	weight	—	—	—	—	—	0.02
cf *Celtis* sp. (cf hackberries)	weight	—	—	—	—	—	—
Ulmus sp. (elm)	weight	—	—	—	—	0.02	0.03
Deciduous forest-scrub							
Quercus spp. deciduous (deciduous oaks)	weight	0.89	0.96	4.72	3.95	0.81	1.64
Hippophae rhamnoides (seaberry)	weight	—	—	—	—	—	—
Acer spp. (maple)	weight	—	—	—	—	—	0.02
Ostrya carpinifolia (hop-hornbeam)	weight	—	—	—	—	—	—
Rhamnus sp. (buckthorn)	weight	—	—	—	—	—	—
Fraxinus sp. (ash)	weight	—	—	0.03	—	—	—
cf *Fraxinus* sp. (cf ash)	weight						
Economic trees							
Fraxinus ang. /ornus (narrow-l. or manna ash)	weight	—	—	—	—	—	—
Elaeagnus angustifolia (Russian olive)	weight	—	—	—	—	—	—
cf *Elaeagnus angustifolia (cf Russian olive)*	weight	—	—	—	—	—	—
cf *Ficus carica* (cf common fig)	weight	—	—	—	—	—	—
Juglans regia (walnut)	weight	—	—	—	—	—	—
Morus sp. (mulberry)	weight	—	—	—	—	—	—
Maloideae (apple subfamily)	weight	—	—	—	—	—	0.02
cf maloideae (cf apple subfamily)	weight	—	—	—	—	—	—
Pistacia sp. (pistachio)	weight	0.02	0.02	0.17	0.14	—	—
Amygdalus -type (almond type)	weight	—	—	—	—	—	0.05
Prunus -type (plums type)	weight	—	—	0.49	0.04	—	—
Amygdalus/Prunus (almond/plums type)	weight	0.06	—	0.06	—	—	0.11
cf *Prunus-type* (cf plums-type)	weight	—	—	—	—	—	—
Vitis vinifera (grapevine)	weight	—	—	—	—	—	—
cf *Vitis vinifera (cf grapevine)*	weight						
Shrubs							
Asteraceae-type (Aster family type)	weight	—	—	—	—	—	—
Euphorbia sp. (spurges)	weight	—	—	—	—	—	—
Chenopodiaceae (goosefoot family)	weight	—	—	—	—	—	—
Monocotyledonae (monocots)	weight	—	—	—	—	—	—
Exotic taxa							
Buxus sempervirens (boxwood)	weight	—	—	—	—	—	—
Indeterminable charcoals							
Unknown taxa	weight	—	0.04	—	—	—	—
Indeterminable	weight	0.09	—	0.03	—	0.02	0.24
Indeterminable broadleaf	weight	—	0.02	0.09	0.04	—	—
Indeterminable conifer	weight	—	—	—	—	—	—
root broadleaf	weight	—	—	—	—	—	—
bark	weight	—	—	—	—	0.05	0.06
Sums							
Analyzed charcoal	weight analyzed	2.49	1.13	6.14	4.95	1.14	2.46
Total charcoal	weight total	2.49	1.13	6.14	11.30	1.14	2.46
4mmCharcoalCONC	wg/10liter	0.8300	0.5650	1.9188	2.3061	1.1400	1.6000

APPENDIX 6

Catalogue of the carpological flora from Niğde-Kınık Höyük

In this appendix for each taxon identified in the carpological record (Chapter 6) I provide: (*i*) a list of the candidate taxa in the Turkish flora, with a brief note on their ecology; (*ii*) a discussion of the criteria on which the identification is based; and (*iii*) the attestations in the Niğde-Kınık Höyük dataset (ubiquity and number of fragments for each occupation period). Taxonomy follows the Flora of Turkey (Davis 1965-1985).

ALISMATACEAE 762
Alisma sp.

APIACEAE 762
Apium-Type
Bifora radians
Bupleurum-Type
Coriandrum sativum
Torilis sp.

ASTERACEAE 765
Artemisia sp.
Aster-Type
Calendula sp.
Carduus nutans-Type
Centaurea sp.
Cichorium sp.
Chondrilla juncea
Crepis-Type
Onopordum sp.
Scorzonera sp.

BORAGINACEAE 769
Buglossoides tenuiflora
Buglossoides arvensis/*Arnebia decumbens*
Echium sp.

Heliotropium sp.
Onosma sp.
Symphytum-Type

BRASSICACEAE 772
Alyssum-Type
Brassica-Type
Camelina-Type
Cardaria draba
Conringia-Type
Descurania-Type
Euclidium syriacum
Lepidium perfoliatum
Neslia paniculata

CARYOPHYLLACEAE 777
Bufonia sp.
Gypsophila sp.
Holosteum umbellatum
Silene sp.
Vaccaria pyramidata

CHENOPODIACEAE 779
Atriplex sp.
Beta sp.
Chenopodium sp.
Chenopodium murale-Type
Salsola sp.
Suaeda sp.

CISTACEAE 783
Helianthemum sp.

CONVOLVULACEAE 783
Convolvulus sp.

CUPRESSACEAE 784
Juniperus excelsia-Type

CYPERACEAE 785
Boloschoenus glaucus
Carex spp. (flattened type)
Carex spp. (trigonous type)
Cyperus longus
Eleocharis sp.
Fimbristylis sp.
Scirpoides holoschoenus

DIPSACACEAE ____ 789
Cephalaria sp.
Dipsacus sp.
Scabiosa sp.

ELAEAGNACEAE ____ 790
Elaeagnus angustifolia

EUPHORBIACEAE ____ 790
Euphorbia falcata-Type
Euphorbia taurinensis-Type

FABACEAE (non-economic taxa) ____ 791
Astragalus-Type
Coronilla-Type
Medicago-Type
Medicago sp.
Medicago radiata
Melilotus-Type
Trifolium-Type
Trigonella-Type
Onobrychis sp.

FABACEAE (economic taxa) ____ 795
Cicer arietinum
Lens culinaris
Pisum sativum
Vicia ervilia
Vicia faba

FAGACEAE ____ 797
Quercus sp. (tentative)

JUGLANDACEAE ____ 797
Juglans regia

LAMIACEAE ____ 798
Ajuga-Type
Ajuga chamaepitys
Lallemantia-Type
Mentha sp.
Nepeta sp.
Stachys-Type
Teucrium-Type
Ziziphora sp.

LILIACEAE 801
Allium-Type
Bellevalia sp.
Ornithogalum sp.

LINACEAE 802
Linum usitatissimum

MALVACEAE 803
Malva sp.

MORACEAE 803
Ficus carica

PAPAVERACEAE 804
Fumaria sp.
Glaucium sp.
Papaver spp.

PINACEAE 805
Abies sp.

PLANTAGINACEAE 806
Plantago sp.

POACEAE (non-economic taxa) 806
Aegilops sp.
Bromus sp.
Eremopyrum-Type
Festuca sp.
Hordeum sp.
Lolium sp.
Micropyrum-Type
Phalaris-Type
Poa bulbosa
Setaria viridis/verticellata-Type
Stipa sp.
Taeniatherum caput-medusae

POACEAE (economic taxa) 812
Hordeum vulgare ssp. *distichon*
Hordeum vulgare ssp. *vulgare*
Hordeum vulgare var. *nudum*
Triticum monococcum
Triticum dicoccum
Triticum aestivum/durum
Triticum aestivum

Triticum durum
Secale cereale
Panicum miliaceum
Setaria italica

POLYGONACEAE ____ 818
Polygonum sp.
Polygonum aviculare-Type
Polygonum convolvulus
Persicaria-Type
Rumex sp.

PORTULACACEAE ____ 821
Portulaca oleracea

POTAMOGETONACEAE ____ 821
Potamogeton sp.

PRIMULACEAE ____ 821
Androsace maxima

RANUNCULACEAE ____ 822
Adonis sp.
Ceratocephalus falcatus
Ranunculus sp.

RESEDACEAE ____ 823
Reseda lutea-Type

ROSACEAE ____ 824
Crataegus sp.
Prunus sp.
Pyrus/Malus
Rubus sp.
Sanguisorba sp.

RUBIACEAE ____ 826
Asperula arvensis/orientalis
Asperula sp.
Galium sp.

SCROPHULARIACEAE ____ 828
Scrophularia/Verbascum
Veronica dillenii-Type
Veronica hederifolia
Veronica polita-Type
Veronica triphyllos

SOLANACEAE 830
Hyoscyamus sp.
Solanum sp.

THYMELAEACEAE 831
Thymelaea sp.

ULMACEAE 832
Celtis sp.

VALERIANACEAE 832
Valerianella coronate-Type
Valerianella vesicaria-Type

VITACEAE 833
Vitis vinifera

ZYGOPHYLLACEAE 834
Peganum harmala
Tribulus terrestris

UNKNOWN SEED/FRUIT 835
KH-unk1
KH-unk2
KH-unk3
KH-unk4
KH-unk5
KH-unk6
KH-unk7
KH-unk8
KH-unk9
KH-unk10
KH-unk11

MISCELLANIA PLANT PARTS 837
Monocots culm
Root
Bud
Sclerotia
Sheep-Goat dung pellet
Seed clots
Vegetal plaster

INSECTA 839
Unknown larvae
Sitophilus granaries
Unknown *Coleoptera*

ALISMATACEAE

- ***Alisma* sp.** – water-plantain genus

Three species of Alisma are listed in the Flora of Turkey: *A. plantago-aquatica*, *A. lanceolatum*, *A. gramineum*. Water-plantains are perennial aquatic herbs, growing on shores of lakes and rivers, ditches, marshes, shallow/stagnant water.

Identification notes: linear U-shaped seed, with a surface characterized by a distinct linearly arranged pattern. Confusion with *Sagittaria* spp., a second member of the family, is excluded based on the straight sides of the specimens here considered. An identification to the species level is not aimed due to limited access to comparative material.

Bibliography: Cappers et al. 2012: 47-49

Plate 7 – a, b

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (4/56)

Count: KH-P II (23); KH-P III (75)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P II (2/41); KH-P III (9/56); KH-P IV (7/31); KH-P VB (3/9)

Count: KH-P II (25); KH-P III (127); KH-P IV (10); KH-P VB (3)

APIACEAE (Umbelliferae)

The fruit in the Apiaceae family is a schizocarp. A 1-seeded mericarp is the most common dispersal unit. Mericarps are characterized by noticeable ribbing, with a variable number of primary ribs, secondary ribs, and oil ducts. Various ornamentations (hairs, papillae, spines, scales) are common. Due to burning, diagnostic features are not always preserved in archaeological specimens, making the identification at the genus/species level often challenging. A precise taxonomic identification is further complicated by the floristic richness of the Apiaceae family, with 97 genera described in the Flora of Turkey.

- *Apium*-Type

Biennial or perennial plant. Two species of *Apium* are described in the flora of Turkey: *A. graveolens* (celery) and *A. nodiflorum*.

Identification notes: schizocarps, elliptic to ovate in shape. Ridges are present on the dorsal side. Due to the degree of similarity with other Apiaceae, the identification is cautiously regarded as type.

Bibliography: Bojnanský and Fargašová 2007: 447

Plate 7 – c

Plant part: schizocarp

Preservation: charred

Ubiquity: KH-P II (2/41)

Count: KH-P II (4)

- ***Bifora radians*** – wild bishop

Annual herb growing on waste ground and field sides. Relatively widespread in central Anatolia.

Identification notes: schizocarp, globular in shape and with a very distinctive cordate hilum. Confusion with *B. testiculata* is considered unlikely based on hilum anatomy.

Bibliography: Bojnanský and Fargašová 2007: 473

Plate 7 – d

Plant part: schizocarp

Preservation: charred

Ubiquity: KH-P IV (1/21)

Count: KH-P IV (1)

- ***Bupleurum* Type** – thorough wax type

Bupleurum is a large genus which includes more than 56 species in the Turkish flora.

Identification notes: schizocarp, globular in shape. The dorsal side is convex and ridged, the ventral side is flat and with linear furrow.

Bibliography: Bojnanský and Fargašová 2007: 473; Çizer 2015: 177-178

Plate 7 – e

Plant part: schizocarp

Preservation: charred

Ubiquity: KH-P III (2/56)

Count: KH-P III (2)

- ***Coriandrum sativum*** – coriander

Cultivated or naturally growing – in oak scrubs, waste ground, and fallow fields. The presence of indehiscent forms could be indicative of domestication.

Identification notes: schizocarp, semi-globose in shape. The dorsal side convex, the ventral side is concave and ridged (alternated straight and sinuate).

Bibliography: Bojnanský and Fargašová 2007: 473

Plate 7 – f

Plant part: schizocarp

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

- ***Torilis* sp.** – hedge parsley

In the Flora of Turkey 8 species are recorded for the genus *Torilis*. They are generally found on slopes, fields, and waste ground.

Identification notes: schizocarp, elongated, linear-cylindric in shape with pointed ends. The dorsal side is ridged, the ventral side is concave. The wavy outline is due to the presence of spiny appendices, not preserved in archaeological specimens due to charring.

Bibliography: Bojnanský and Fargašová 2007: 469; Rihel 1999: 109

Plate 7 – g

Plant part: schizocarp

Preservation: charred

Ubiquity: KH-P II (2/41)

Count: KH-P II (2)

ASTERACEAE (Compositae)

Annual, biennial, or perennial herbs or shrubs. The Asteraceae family is extremely large and complex, with 129 genera recorded in the Flora of Turkey. The distinctive infructescence is a capitulum, composed by indehiscent single-seeded fruits (achene). A hilum scar is present at the base of the achene, while a pappus may be present on its apex.

- ***Artemisia* sp.** – mugworts

Annual, biennial, or perennial herbs or shrubs. 22 species are described in the Flora of Turkey. As noted by Davis (1975: 311), the distribution of the genus in central Anatolia is impacted by overgrazing.

Identification notes: two different types of infructescence are identified in the N-KH assemblage. The achenes are obovoid-pyriform in shape and with a surface longitudinally furrowed.

Bibliography: Bojnanský and Fargašová 2007: 699-703

Plate 7 – h

Plate 8 – a, b

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (4/56); KH-P IV (2/31); KH-P VA (1/10).

Count: KH-P II (3); KH-P III (61); KH-P IV (3); KH-P VA (2).

Plant part: small capitulum with achenes

Preservation: charred

Ubiquity: KH-P IV (8/31); KH-P VA (2/10)

Count: KH-P IV (2761); KH-P VA (25)

Plant part: large capitulum

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P III (2/56)

Count: KH-P I (1); KH-P III (2)

- ***Aster*-Type** – aster Type

Biennial and perennial herbs. 6 species of *Aster* are described in the Flora of Turkey.

Identification notes: achenes are obovate and compressed. The apex is characterized by the presence of a collaret. Longitudinal ridges are present on the surface. This identification is cautiously considered as type, considering the possible confusion with other Astereae.

Bibliography: Bojnanský and Fargašová 2007: 657-661

Plate 8 – c

Plant part: achene

Preservation: charred

Ubiquity: KH-P III (3/56); KH-P IV (1/31)

Count: KH-P III (3); KH-P IV (1)

- ***Calendula* sp.** – pot marigold genus

Annual of perennial herbs. Three species of *Calendula* are described in the Flora of Turkey, among which *C. arvensis* is the most widespread in Anatolia. The latter species grows in cultivated fields, roadsides, and waste ground.

Identification notes: crescent shaped achene, characterized by the presence of a distinctive verrucose ornamentation on the dorsal side.

Bibliography: Bojnanský and Fargašová 2007: 713

Plate 8 – d

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

- ***Carduus nutans*-Type** – musk thistle type

Biennial sturdy herb, widespread in Anatolia. The taxonomy of this species is complex, with several subspecies recorded (Davis 1975:462). It grows mainly in steppe, rocky slopes, fields, and waste places.

Identification notes: obovoid achenes with truncated apex, narrowing toward the base. The surface is transversely wrinkly and with shallow longitudinal furrows. The specimens from N-KH are smaller (~1.5/2.5 x 0.8/1.2 mm) than the ones described by Bojnanský and Fargašová 2007 (3.5-4 x 1.4-1.7 mm).

Differences in sizes are, however, possibly due to the number of subspecies recorded. Considering the lack of adequate reference materials, this identification is regarded as type.

Bibliography: Bojnanský and Fargašová 2007: 721

Plate 8 – e

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (6)

- ***Centaurea* sp.** – knapweeds

Annual, biennial, or perennial herbs, rarely small shrubs. *Centaurea* is an extremely large genus, with more than 172 species described in the Flora of Turkey.

Identification notes: elongated achene, with a rimmed truncated apex and a distinctive hooked base. The surface is smooth.

Bibliography: Bojnanský and Fargašová 2007: 727 and ss.

Plate 8 – f, g

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (10/41); KH-P III (7/56); KH-P IV (3/31)

Count: KH-P I (9); KH-P II (15); KH-P III (16); KH-P IV (9)

- ***Cichorium* sp.** – chicory

Annual, biennial, or perennial herbs. 5 species recorded in the Flora of Turkey.

Identification notes: Small capitulum, containing 10-15 obconic angular achenes with a truncated apex.

Bibliography: Bojnanský and Fargašová 2007: 739

Plate 8 – h

Plate 9 – a

Plant part: capitulum with achenes

Preservation: charred

Ubiquity: KH-P IV (2/31)

Count: KH-P IV (12)

- ***Chondrilla juncea*** – rush skeleton-weed

Biennial or perennial herb, with a woody base. Widespread in Anatolia, generally growing on rocky and sandy places, and fallow fields.

Identification notes: obcylindric achenes, with a spiny or scaled apex. The surface is longitudinally furrowed, with the proximal end of the achene glabrous and its central part verrucose.

Bibliography: Bojnanský and Fargašová 2007: 753

Plate 9 – b

Plant part: achene

Preservation: uncharred

Ubiquity: KH-P VA (1/10)

Count: KH-P VA (1)

- ***Crepis*-Type** – hawksbeard Type

Annual, biennial, or perennial plants. More than 36 species of *Crepis* are described in the Flora of Turkey.

Identification notes: slightly compressed spindle-shaped achene. The apex is rounded, while the base is pointed. The surface is longitudinally ribbed. Identified as type due to potential confusion with other cichoriaceae.

Bibliography: Bojnanský and Fargašová 2007: 753-757

Plate 9 – c

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

- ***Onopordum* sp.** – onopordo

Biennial plants, 16 species are listed in the Flora of Turkey. *Onopordum* generally grows on slopes, dry meadows, fallow fields, and disturbed soil.

Identification notes: achenes tetragonal, with distinctive transversally undulate rugulose surface.

Bibliography: Bojnanský and Fargašová 2007: 725-727

Plate 9 – d, e

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (2/41); KH-P III (9/56); KH-P IV (1/31)

Count: KH-P I (1); KH-P II (2); KH-P III (37); KH-P IV (2)

- ***Scorzonera* sp.** – viper's grass

Annual, biennial, or perennial herbs, rhizomatous or tuberous. *S. hispanica* is cultivated for its edible roots. 39 species of *Scorzonera* are listed in the Flora of Turkey.

Identification notes: elongated cylindric achene; the surface is ornamented by deep longitudinal ribs.

Bibliography: Bojnanský and Fargašová 2007: 7

Plate 9 – f

Plant part: achene

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

BORAGINACEAE

- ***Buglossoides tenuiflora*** – gromwell

Annual herb, commonly growing on limestone slopes and stony places.

Identification notes: bigibbous nutlets, with an elongated apex and a relatively small base. The surface is covered by wart-like projections.

Bibliography: van Zeist and Bakker-Heeres 1985: 212-213; Riehl 1999: 90

Plate 9 – g

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (1/56)

Count: KH-P II (2); KH-P III (1)

- ***Buglossoides arvensis*/*Arnebia decumbens***

Annual herbs, commonly growing on limestone slopes, field margins, cornfields, rocky places, fall fields, steppe.

Identification notes: ovoid nutlet, with a distinct keel on the ventral side. The base is truncated, oval or rhomboidal in shape; the apex is pointed. The surface of the nutlet is dull, densely covered with wart-like projections.

Bibliography: Bojnanský and Fargašová 2007: 545

Plate 9 – h

Plate 10 – a

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (17/41); KH-P III (39/56); KH-P IV (6/31); KH-P VB (3/9); KH-P VI (1)

Count: KH-P I (5); KH-P II (48); KH-P III (498); KH-P IV (7); KH-P VB (4); KH-P VI (1)

Plant part: nutlet

Preservation: uncharred

Ubiquity: KH-P I (3/25); KH-P II (7/41); KH-P III (32/56); KH-P IV (10/31); KH-P VA (4/10); KH-P VB (5/9); KH-P VI (2/2)

Count: KH-P I (3); KH-P II (19); KH-P III (289); KH-P IV (69); KH-P VA (14); KH-P VB (9); KH-P VI (2)

***Echium* sp.** – viper's buglosses

Annual to perennial herbs; 9 species are listed in the Turkish Flora. *Echium* is commonly growing on dry limestone slopes, stony places, and fields.

Identification notes: ovoid-trigonal nutlet, with distinct keel on both the ventral and dorsal side. Flat large base, distinct by a collar; apex pointed. Surface rugose-tuberculate.

Bibliography: Bojnanský and Fargašová 2007: 549; Riehl 1999: 90

Plate 10 – b, c, d

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P I (5/25); KH-P II (5/41); KH-P III (13/56)

Count: KH-P I (801); KH-P II (51); KH-P III (119)

Plant part: nutlet

Preservation: uncharred

Ubiquity: KH-P I (4/25); KH-P II (4/41); KH-P III (13/56); KH-P IV (1/31)

Count: KH-P I (630); KH-P II (148); KH-P III (1177); KH-P IV (1)

***Heliotropium* sp.** – heliotropes

Suffruticose perennials and annual herbs; 14 species are recorded in the Turkish Flora. The species is reported to grow in both natural and disturbed vegetation, including fields.

Identification notes: pear-shaped nutlet, narrowing at the hilum end. The surface is irregularly wrinkled. At the base it is easily visible a protruding circular hilum.

Bibliography: Bojnanský and Fargašová 2007: 545; Riehl 1999: 90; van Zeist and Bakker-Heeres 1985: 212

Plate 10 – e, f

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (2/41); KH-P III (12/56); KH-P IV (9/31); KH-P VA (2/10); KH-P VB (2/9)

Count: KH-P I (7); KH-P II (10); KH-P III (29); KH-P IV (12); KH-P VA (3); KH-P VB (2)

Plant part: nutlet

Preservation: uncharred

Ubiquity: KH-P III (1/56)

Count: KH-P III (1)

- ***Onosma* sp.** – onosma

Perennial, usually suffruticose, herbs or biennial herbs. Very large genus, with more than 84 species listed in the Flora of Turkey.

Identification notes: Nutlets ovoid, with a convex dorsal side convex, ventral keel, and trigonous base.

The surface is smooth.

Bibliography: Bojnanský and Fargašová 2007: 545-547

Plate 10 – g, h

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (1/41); KH-P III (1/56)

Count: KH-P I (7); KH-P II (1); KH-P III (1)

Plant part: nutlet

Preservation: uncharred

Ubiquity: KH-P II (1/41)

Count: KH-P I (3)

- ***Symphytum*-Type** – common comfrey

Perennial, usually hispid herbs; 20 species of *Symphytum* are described in the Flora of Turkey.

Identification notes: ovoid nutlets, having a distinctive collar-like basal ring. Th surface is smooth. The identification is considered as type due to lake of comparative materials, *S. officinale* is larger than the specimen from N-KH.

Bibliography: Bojnanský and Fargašová 2007: 551-553

Plate 11 – a

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

BRASSICACEAE (Cruciferae)

Very large family, encompassing more than 85 genera in the Flora of Turkey. Several taxa are of economic importance. The most common distinctive fruit of the family is a silique/silicula, containing seeds either spherical or flattened and commonly with an ornamented seed coat. The embryo is usually bended or folded, which gives to the seed a distinctive outline. The dispersal unit is either the seed, a segment of the fruit, the whole fruit, or the entire plant. Botanical identification is based on fruit anatomy, which is only very rarely accessible in archaeological materials. Identification to the species level of archaeological specimens requires access to large reference collections and often the microscopic (SEM) observations of the seed coat (if preserved).

- ***Alyssum*-Type** – alyssum type

Annuals, biennial, or perennial herbs. More than 89 species of *Alyssum* are listed in the Flora of Turkey. It is found in several different habitats, including limestone slopes, steppe, and fallow fields.

Identification notes: seeds are obovate-elliptic in outline, flattened. The radicle forms a narrow tip. A narrow membranous wing, often not preserved in archaeological specimens, surrounds the seed. On the surface are present very fine papillae.

Bibliography: Bojnanský and Fargašová 2007: 197-201

Plate 11 – b

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (3/56)

Count: KH-P II (1); KH-P III (7)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P III (1/56); KH-P VA (1/10)

Count: KH-P III (2); KH-P VA (1)

- ***Brassica*-Type** – cabbages type

Annuals, biennial, or perennial herbs. 5 species of *Brassica* are listed in the Flora of Turkey, without considered domesticated and cultivated cabbages. *B. elongata* grows in the Anatolian Plateau, on dry-rocky slopes, steppe, and cultivated fields.

Identification notes: spherical seeds, the surface is with a reticulate patter.

Bibliography: Bojnanský and Fargašová 2007: 173-177

Plate 11 – c, d

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (4/41); KH-P III (4/56); KH-P IV (2/31)

Count: KH-P I (2); KH-P II (23); KH-P III (6); KH-P IV (7)

- ***Camelina*-Type** – dorella type

Annual or biennial herbs, 6 species are recorded in the Flora of Turkey.

Identification notes: ellipsoid seed, nearly round in cross-section. The tip of radicle slightly protrudes from the seed outline. The surface is densely covered by noticeable papillae.

Bibliography: Bojnanský and Fargašová 2007: 191-193

Plate 11 – e

Plant part: seed

Preservation: charred

Ubiquity: KH-P VA (1/10)

Count: KH-P VA (1)

- ***Cardaria draba*** – whitetop cress

Perennial stoloniferous herbs. The genus *Cardaria* is monospecific in Anatolia. Widespread, generally growing in cultivated fields.

Identification notes: elliptic-obovate seed, nearly round in cross-section. The seam between the beak and the body is at the center of the seed. The surface is velvet-like, very finely reticulate. Distinction from *Lepidium* based on the rounded cross-section.

Bibliography: Bojnanský and Fargašová 2007: 185

Plate 11 – f

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P III (3/56); KH-P IV (5/31)

Count: KH-P I (2); KH-P III (5); KH-P IV (7)

- ***Conringia*-Type** – hare's ear mustards type

Annual herb. 6 species of *Conringia* are described in the Flora of Turkey. *C. perfoliata* is widespread in C-Anatolia, commonly growing in cultivated land, roadside, and stony slopes.

Identification notes: ovoid or elliptic seed, with a straight beak. The surface is dull, with distinct large bumps.

Bibliography: Bojnanský and Fargašová 2007: 183

Plate 11 – g

Plant part: seed

Preservation: charred

Ubiquity: KH-P VA (1/10)

Count: KH-P VA (1)

- ***Descurainia*-Type** – erba Sofia genus type

Annual or biennial herbs, with two species recorded in the Flora of Turkey: *D. sophia*, *D. kochii*. *D. sophia* is more commonly found in C-Anatolia, growing on waste places.

Identification notes: elliptic seed with a rounded apex and a truncate base, rounded in cross section. The surface is lustrous.

Bibliography: Bojnanský and Fargašová 2007: 211

Plate 11 – h

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P IV (2/31); (KH-P VA (1/10); KH-P VB (2/9)

Count: KH-P II (11); KH-P IV (2); KH-P VA (1); KH-P VB (3)

- ***Euclidium syriacum***

Annual herb widespread in Anatolia, commonly growing in steppe in field habitats.

Identification notes: indehiscent 2-seeded fruit, septate, ovoid, with a distinctive beak. The fruit valves show a reticulate pattern. The hairs observed in modern specimens are not preserved in archaeological specimens due to carbonization.

Bibliography: Bojnanský and Fargašová 2007: 201; van Zeist et al 1984: 207

Plate 12 – a, b

Plant part: silicle with seeds

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (5/41); KH-P III (12/56); KH-P IV (1/31)

Count: KH-P I (1); KH-P II (13); KH-P III (21); KH-P IV (1)

- ***Lepidium perfoliatum*** – perfoliate pepperwort

Annual or biennial herb, widespread in Anatolia. *L. perfoliatum* commonly grows in cultivated land, waste places, stony slopes, and salt steppes.

Identification notes: obovate, flat, seed. The base is subacute, with winged margins. A curved seam is present between the cotyledons and the radicle, centered in the seed outline. The surface is finely ornamented, velvet-like.

Bibliography: Bojnanský and Fargašová 2007: 183

Plate 12 – c

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (4/41); KH-P III (3/56); KH-P IV (1/31); KH-P VA (1/10)

Count: KH-P I (13); KH-P II (118); KH-P III (3); KH-P IV (10); KH-P VA (12)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P II (2/41); KH-P III (1/56); KH-P IV (1/31); KH-P VA (1/10)

Count: KH-P II (3); KH-P III (1); KH-P IV (1); KH-P VA (8)

- ***Neslia paniculata*** – ball mustard

Annual herb, growing on fields, roadsides, rocky slopes. In the Flora of Turkey, two species are recorded: *N. paniculata* and *N. apiculata*. The latter is, however, currently reclassified as subspecies (*N. paniculata* subsp. *thracica*).

Identification notes: one-seeded fruits, almost circular in outline and with a distinctive reticulate surface.

Bibliography: Bojnanský and Fargašová 2007: 193; van Zeist et al 1984: 207

Plate 12 – f

Plant part: silicle

Preservation: charred

Ubiquity: KH-P III (1/56); KH-P VA (1/10)

Count: KH-P III (1); KH-P VA (1)

CARYOPHYLLACEAE

- ***Bufonia* sp.** –bufonia

4 species of *Bufonia* are recorded in the Flora of Turkey, they are found on slopes and fields.

Identification notes: ovate seed, relatively flat. At one end two blunt beaks are present, the other end is curved. The surface is Papillate. Due to the lack of adequate reference material, an identification to the species level is not aimed. The identification is based on modern materials.

Plate 12 – g

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (1/56)

Count: KH-P II (1); KH-P III (1)

- ***Gypsophila spp.*** – baby's-breath

Annual, biennial, or perennial herbs. Very large genus, with more than 45 species recorded in the Flora of Turkey.

Identification notes: reniform to sub-globular seed, with distinct beak. The surface is with distinct papillae. It is possible to point to the presence of more than one species in the N-KH record. A more precise identification is not aimed, due to the large number of species included in the genus, which are not fully covered in the available reference material.

Bibliography: Bojnanský and Fargašová 2007: 79-81

Plate 12 – h

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (4/56); KH-P IV (3/31); KH-P VA (2/10); KH-P VB (1/9)

Count: KH-P II (2); KH-P III (8); KH-P IV (3); KH-P VA (4); KH-P VB (1)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (7)

- ***Holosteum umbellatum*** – jagged chickweed

Annual herb growing in open places and fields.

Identification notes: shield-shaped seed. Dorsal side with wide shallow furrow, ventral side with central ridge. Surface with star-like papillae, linear ornamentation on the ridge.

Bibliography: Bojnanský and Fargašová 2007: 59

Plate 13 – a

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

- ***Silene* spp.** – catchflies

Annual, biennial, or perennial herbs. *Silene* is a very large genus, with more than 119 species recorded in the Flora of Turkey.

Identification notes: reniform seed, with symmetrically curved ends. The surface is ornamented, with either papillae or ridges. Based on surface decoration, it is possible to reconstruct the presence of more than one species in the N-KH record. A more precise identification is not aimed, due to the large number of species included in the genus, which are not fully covered in the available reference material.

Bibliography: Bojnanský and Fargašová 2007: 69-79

Plate 13 – b

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (3/25); KH-P II (4/41); KH-P III (7/56); KH-P IV (12/31); KH-P VA (2/10); KH-P VB (5/9)

Count: KH-P I (3); KH-P II (7); KH-P III (11); KH-P IV (21); KH-P VA (2); KH-P VB (7)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P I (1/25); KH-P IV (1/31)

Count: KH-P I (1); KH-P IV (1)

Vaccaria pyramidata – cowherb

Annual herb. The genus *Vaccaria* is monospecific in Turkey, with 4 varieties described in the Flora of Turkey. *V. pyramidata* is a common field weed; it grows also in cultivated lands and steppe-like habitats

Identification notes: round seed, with surface covered by papillae. Linear pattern in proximity of the hilum. In the charred materials, these seeds often pop in two halves, divided by a central extrusion of shiny burn material.

Bibliography: Bojnanský and Fargašová 2007: 81

Plate 13 – c, d, e

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (5/25); KH-P II (11/41); KH-P III (19/56); KH-P IV (7/31); KH-P VA (3/10); KH-P VB (3/9)

Count: KH-P I (11); KH-P II (38); KH-P III (66); KH-P IV (45); KH-P VA (4); KH-P VB (4)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P IV (5/31); KH-P VA (1/10)

Count: KH-P IV (22); KH-P VA (2)

CHENOPODIACEAE

Seeds are disc-shaped, generally black, and shiny. The embryo is coiled. Depending on the genera, fruit and seed may be fused together or separated. An identification at the species level based on seed anatomy is complicated by strong similarities within genera (Cappers and Bekker 2013: 17). Poorly preserved specimens were identified to the family level. It should be noted that a single plant of Chenopodiaceae can produce a very significant number of seeds. Plants in the Chenopodiaceae family have been recently reassigned to the Amaranthaceae. In accordance with the Flora of Turkey, in this work it is followed the obsolete classification of Chenopodiaceae as a self-standing family.

- ***Atriplex* sp.** – saltbushes

Annual herbs or shrubs, 13 species listed in the Flora of Turkey. Several *Atriplex* species are well adapted to dry and salty soils, common in cultivated fields.

Identification notes: circular seeds, relatively flattened. The outline of the ringlike embryo is evident on the exterior. The embryo forms a beak protruding outside the seed outline. In some samples the bracts fragments are present still appressed on the seed. Bracts are triangular, with distinct nervures. The presence of specimens preserving the perianth may allow identification to the species level, which is however currently hampered by limited comparative materials.

Bibliography: Davis 1967: 307; Bojnanský and Fargašová 2007: 101-105

Plate 13 – f, g, h

Plate 14 – a

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (15/41); KH-P III (12/56); KH-P IV (11/31); KH-P VA (1/10); KH-P VB (4/9)

Count: KH-P I (23); KH-P II (437); KH-P III (117); KH-P IV (99); KH-P VA (3); KH-P VB (12)

Plant part: bracteole

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (2/41); KH-P III (1/56); KH-P IV (3/31)

Count: KH-P I (1); KH-P II (11); KH-P III (1); KH-P IV (12)

- ***Beta* sp.** – beets

Annual to perennial herbs. 6 species recorded in the Flora of Turkey, without include the cultivated *B. vulgaris* (common beet). In C-Anatolia *Beta* is attested in cultivate fields, steppe, and roadsides (e.g., *B.*

tyrigna and *B. lomatogona*).

Identification notes: flattened, roughly circular, seed having a distinctive long beak. Significantly larger than others taxa with a similar gross anatomy in the Chenopodiaceae family.

Bibliography: Bojnanský and Fargašová 2007: 95-97

Plate 14 – b

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (2)

- ***Chenopodium* sp.** – goosefoots

11 species of goosefoot are recorded in the flora of Turkey. Goosefoots are a common weed in cultivated fields, growing also in steppe and roadsides

Identification notes: seeds roundish, with a distinct radicle. A furrow between the radicle and cotyledons is visible.

Bibliography: Bojnanský and Fargašová 2007: 97-101

Plate 14 – c, d

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (15/25); KH-P II (18/41); KH-P III (34/56); KH-P IV (19/31); KH-P VA (10/10); KH-P VB (6/9); KH-P VI (2/2)

Count: KH-P I (314); KH-P II (237); KH-P III (256); KH-P IV (102); KH-P VA (63); KH-P VB (27); KH-P VI (7)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P I (1/25); KH-P III (1/56); KH-P IV (1/31); KH-P VA (2/10)

Count: KH-P I (1); KH-P III (1); KH-P IV (2); KH-P VA (15)

- ***Chenopodium murale*-Type** – nettle-leaved goosefoot type

Annual herb found in waste places, roadsides, rocky areas.

Identification notes: the distinction from other *Chenopodium* spp. is based on the presence of a distinct keen on the external outline.

Bibliography: Bojnanský and Fargašová 2007: 99; Riehl 1999: 92

Plate 14 – e

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (1/41); KH-P III (2/56); KH-P VB (1)

Count: KH-P I (1); KH-P II (9); KH-P III (5); KH-P VB (1)

- ***Salsola* sp.** – saltwort

Herbs or low shrubs; 13 species of *Salsola* are recorded in the Flora of Turkey. Salt resistant plants, growing on coastal environments and inland waste places.

Identification notes: seed having a distinctive coiled shape. In the N-KH assemblage, two morphotypes are identified: flat (*S. kali*-Type) and a semi-spherical (*S. soda*-Type). Because of the frequent presence of intermediate forms, the distinction between the two types is not quantified.

Bibliography: Bojnanský and Fargašová 2007: 109

Plate 14 – f, g

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (6/25); KH-P II (15/41); KH-P III (22/56); KH-P IV (13/31); KH-P VA (6/10); KH-P VB (2/9); KH-P VI (1/2)

Count: KH-P I (26); KH-P II (217); KH-P III (94); KH-P IV (38); KH-P VA (21); KH-P VB (2); KH-P VI (1)

- ***Suaeda* sp.** – seepweeds

Annual or perennial plants, with 7 species described in the Flora of Turkey. *Suaeda* generally grows in salty soils and waste places.

Identification notes: circular, biconvex, seed; very similar to Chenopodium. *Suaeda* is, however, distinguished by the presence of a protruding notch in proximity of the radicle tip.

Bibliography: Bojnanský and Fargašová 2007: 109

Plate 14 – h

Plate 15 – a

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (13/25); KH-P II (27/41); KH-P III (44/56); KH-P IV (21/31); KH-P VA (10/10); KH-P VB (8/9); KH-P VI (2/2)

Count: KH-P I (44); KH-P II (121); KH-P III (2081); KH-P IV (82); KH-P VA (51); KH-P VB (40); KH-P VI (17)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P IV (2/31)

Count: KH-P IV (3)

CISTACEAE

- ***Helianthemum* sp.** – sunrose

Dwarf shrubs, perennial, or annual herbs. 12 species of *Helianthemum* are recorded in the Flora of Turkey, with preferential habitat in calcareous dry places, rocky slopes, scrub, and steppe.

Identification notes: ovoid seed. The apex is pointed, the base is rounded with a circular protruding hilum. The surface is densely tuberculate.

Bibliography: Bojnanský and Fargašová 2007: 359

Plate 15 – b

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P IV (1/31); KH-P VA (1/10)

Count: KH-P II (1); KH-P IV (1); KH-P VA (1)

CONVOLVULACEAE

- ***Convolvulus* sp.** – bindweeds

Small woody shrubs/subshrubs, or herbaceous perennials or annuals. 32 species of *Convolvulus* are described in the Flora of Turkey. The members of this genus grow in several habitats, including woodland margins, steppe, and fallow fields. *C. arvensis* is a common weed.

Identification notes: seeds obovoid, with obtuse angles. A large round hilum is present at the base of the seed.

Bibliography: Bojnanský and Fargašová 2007: 537-539

Plate 15 – c, d

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (1/56)

Count: KH-P II (1); KH-P III (1)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

CUPRESSACEAE

- ***Juniperus excelsa*-Type** – Greek juniper type

Evergreen shrubs or trees.

Identification notes: scale-like leaves fragments. In the Turkish flora this anatomy is consistent with *J. Phoenicia* (Mediterranean element), *J. sabina*, *J. foetidissima*, *J. excelsa*.

Bibliography: Davis 1965: 78

Plate 15 – e

Plant part: leave fragment

Preservation: charred

Ubiquity: KH-P III (4/56)

Count: KH-P III (9)

CYPERACEAE

The fruit of the Cyperaceae is an achene, a single seed fused with the fruit. The identification to the genus level is based on shape of the achene, surface patter, size, presence/absence of tubercle (remaining of the stylus on the distal end) and basal bristles (on the proximal end). Poorly preserved specimens are identified to the family level. The identification to the genus level has been particularly challenging for mineralized materials, due to the presence of a wide array of different morphotypes and surface patters. Further work supported by a larger reference collection is needed for a more precise identification of these uncharred specimens. Polygonaceae achenes might superficially resemble Cyperaceae, the two taxa can be distinguished according to seed orientation, type of ornamentation, and position of the embryo in the seed. Some poorly preserved specimens and loose endosperms are attributed to the general category Cyperaceae/Polygonaceae.

- ***Bolboschoenus glaucus*** – glaucus tuber-bullrush

Bolboschoenus glaucus is not described in the Flora of Turkey. The taxonomy of the genus *Bolboschoenus* has been recently revised, materials attributable to this taxon were previously identified as *B. maritimus* (syn. *Scirpus maritimus*). *B. glaucus* is recorded in river shores and river floodplains, it is adapted to summer-dry habitats; if more water is available, it may form large stands. It is reported to grow also in secondary human-disturbed habitats.

Identification notes: the identification follows the criteria recently proposed by Wollstonecroft et al. (2011). Achenes are obovate to elliptic in outline, with a plano-convex to sub-trigonous cross section. The surface is smooth.

Bibliography: Wallstonecroft et al. 2011: 462

Plate 15 – f, g

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (13/41); KH-P III (20/56); KH-P IV (16/31); KH-P VA (4/10); KH-P VB (6/9); KH-P VI (2/2)

Count: KH-P I (6); KH-P II (16); KH-P III (31); KH-P IV (42); KH-P VA (9); KH-P VB (14); KH-P VI (4)

- ***Carex* spp.**– sedges

Carex is a very large and complex genus, with more than 86 species recorded in the Flora of Turkey. Sedges grow in several different habitats, with an overall preference for marshy areas, open forests, and ravines.

Identification notes: identification to the species level was not aimed, due to the large number of species to be considered, which are not adequately covered in reference materials and atlases. Two main types of sedges were identified: flattened and trigonous. The flattened type is ovate to elliptic in outline, with a short beak on the apex and a discoidal to plano-convex transversal section. The trigonous type is 3-angular and with a distinct surface ornamentation.

Bibliography: Berggren 1969; Bojnanský and Fargašová 2007: 833-857

- *Carex* spp. – flattened Type

Plate 15 – h, 16 – a

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (12/25); KH-P II (31/41); KH-P III (46/56); KH-P IV (23/31); KH-P VA (8/10); KH-P VB (9/9)

Count: KH-P I (92); KH-P II (225); KH-P III (1797); KH-P IV (170); KH-P VA (27); KH-P VB (46)

Plant part: achene

Preservation: uncharred

Ubiquity: KH-P II (1/41); KH-P III (4/56); KH-P IV (3/31); KH-P VB (3/9)

Count: KH-P II (1); KH-P III (9); KH-P IV (7); KH-P VB (22).

- *Carex* spp. – trigonous Type

Plate 16 – b, c

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (3/25); KH-P II (10/41); KH-P III (13/56)

Count: KH-P I (6); KH-P II (48); KH-P III (30)

- ***Cyperus longus*-Type** – galingale type

Perennial sedge widely distributed in C-Anatolia, found in swamps riverbanks, and ditches

Identification notes: small and elongated seed, with triangular cross section. The surface is finely granulated.

Bibliography: Bojnanský and Fargašová 2007: 827; Riehl 1999: 94.

Plate 16 – d

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

- ***Eleocharis* spp.** – spike rushes

Annual and perennial plants, 7 species are recorded in the Flora of Turkey. *Eleocharis* prefers moist and wet environments, such as marshy soils, wet meadows, and riversides.

Identification notes: the most distinctive character of these seeds is the presence of a large hat-like tubercle on its apex. Based on differences in surface ornamentation, more than one species is present in the N-KH assemblages. Identification to the species level was, however, not aimed due to preservation issues. Two main types are distinguished: *Eleocharis* sp. – Type 1, characterized by a very large tubercle; and *Eleocharis* sp. – Type 2, having a smaller tubercle. It might be possible that *Eleocharis* is undercounted, considering that the diagnostic tubercle is often not preserved in archaeological specimens.

Bibliography: Berggren 1969: 14-17; Bojnanský and Fargašová 2007: 829

- *Eleocharis* sp. – type 1

Plate 16 – e, f

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (5/41); KH-P III (21/56); KH-P IV (8/31); KH-P VA (1/10)

Count: KH-P II (13); KH-P III (76); KH-P IV (18); KH-P VA (2)

- *Eleocharis* sp. – type 2

Plate 16 – g, h

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (6/41); KH-P III (8/56); KH-P IV (1/31)

Count: KH-P II (379); KH-P III (25); KH-P IV (1)

- ***Fimbristylis* sp.** – fimbry

Annual, rarely perennial, herb. Three species are described in the flora of Turkey.

Identification notes: obovoid achene, biconvex in section. The surface is markedly reticulated.

Bibliography: Bojnanský and Fargašová 2007: 825

Plate 17 – a, b

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (3/41); KH-P III (7/56)

Count: KH-P II (4); KH-P III (25)

Plant part: achene

Preservation: uncharred

Ubiquity: KH-P I (1/25); KH-P II (5/41); KH-P III (10/56)

Count: KH-P I (1); KH-P II (17); KH-P III (69)

- ***Scirpoides holoschoenus*** – roundhead bulrush

Perennial plant, widespread in Anatolia. *S. holoschoenus* grows in marshes, wet meadows, riverbanks, and stream sides.

Identification notes: obovoid, trigonous, achene with beaked apex. The surface transversely wrinkly.

Bibliography: Bojnanský and Fargašová 2007: 831

Plate 17 – c

Plant part: achene

Preservation: charred

Ubiquity: KH-P III (1/56)

Count: KH-P III (5)

DIPSACACEAE

- ***Cephalaria* Type**

Annual, biennial, or perennial herbs. 29 species registered in the Flora of Turkey.

Identification notes: the elongated seed is contained in an 8-angled perianth.

Bibliography: Bojnanský and Fargašová 2007: 519

Plate 17 – d

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (2/41)

Count: KH-P II (3)

- ***Dipsacus*-Type** – teasels

Biennial or annual herbs, 5 species recorded in the Flora of Turkey.

Identification notes: 4-angled elongated fruit. The apex is flat, truncated. The outline is tapering toward the base of the achene.

Bibliography: Bojnanský and Fargašová 2007: 517

Plate 17 – e

Plant part: achene

Preservation: charred

Ubiquity: KH-P III (1/56)

Count: KH-P III (1)

- ***Scabiosa* Type**

Annual and perennial plants. Large genus, with more than 30 species recorded in the Flora of Turkey.

Identification notes: conical 8-angled seed, with curved flattened base and pointed apex.

Bibliography: Bojnanský and Fargašová 2007: 521-523

Plate 17 – f

Plant part: achene

Preservation: charred

Ubiquity: KH-P VB (1/9)

Count: KH-P VB (1)

ELAEAGNACEAE

- ***Elaeagnus angustifolia*** – Russian olive

Shrub or tree, partially spiny. Widespread in central Anatolia, cultivated and along riverbanks and streams. According to Davis (1982: 534) doubtfully native in Turkey, but widely cultivated and naturalized in favorable habitats. Fruits are edible and commonly consumed. *Elaeagnus* trees are also often used as fence.

Identification notes: Seeds are prolonged ovoid or cylindric, with the surface covered in strips.

Bibliography: Bojnanský and Fargašová 2007: 411

Plate 17 – g, h

Plant part: endocarp

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (3/41); KH-P III (4/56)

Count: KH-P I (1); KH-P II (3); KH-P III (6)

EUPHORBIACEAE

- ***Euphorbia falcata*-Type** – sickle spurge type

Annual plant, growing on the edge of conifer forests, *Quercus* scrub, rocky slopes, steppe, moist places, fields, and waste ground.

Identification notes: the identification is to be considered as type, due to the number of species comprised in the genus *Euphorbia* (91 recorded in the Flora of Turkey), which were not fully accessible in reference collections and atlases. *Euphorbia falcata* type indicates obovoid-quadrangular, relatively flat, seed, transversally sulcate.

Bibliography: Bojnanský and Fargašová 2007: 407; Davis 1982: 601

Plate 18 – a

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25)

Count: KH-P I (1)

- ***Euphorbia taurinensis*-Type**

Annual plant, growing in the *Quercus-Phillyrea* woodland, *Pinus brutia* woodland, macchia, phrygana, stony places, marshy meadows, and fallow fields.

Identification notes: the identification is to be considered as type, due to the number of species comprised in the genus *Euphorbia* (91 recorded in the Flora of Turkey), which were not fully accessible in reference collections and atlases. *Euphorbia taurinesis*-Type indicates ellipsoid seeds with reticulated surface.

Bibliography: Davis 1982: 601

Plate 18 – b

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (1/41); KH-P III (1/56); KH-P IV (1/31)

Count: KH-P I (1); KH-P II (1); KH-P III (1); KH-P IV (1)

FABACEAE (Leguminosae) – non-economic taxa

Archaeobotanical identification of members of the Fabaceae family is problematic, due to the large number of taxa included in the family, ongoing and recent taxonomic revisions, strong similarities in seed anatomy between genera/species, and a well-known tendency in crop mimicry (Butler 1996). In this work it is adopted a conservative approach, indicating most identifications of small legumes as types. In poorly preserved specimens the identification was left to the general category of Trifolieae, a tribe of the Fabaceae family used here in order to refer to small legume seeds as a general category.

- ***Astragalus*-Type** – milkvetch type

Annuals, herbaceous perennials, or shrubs. *Astragalus* is an extremely large and complex genus, with 328 species recorded in the Flora of Turkey.

Identification notes: to this type are attributed specimens with on overall sub-ellipsoid to squared outline, with an angular apex. Some seeds were found still contained in the pod.

Bibliography: Riehl 1999: 100

Plate 18 – c

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (3/25); KH-P II (5/41); KH-P III (9/56); KH-P IV (3/31); KH-P VA (1/10); KH-P VB (2/9); KH-P VI (1/2)

Count: KH-P I (6); KH-P II (14); KH-P III (21); KH-P IV (5); KH-P VA (1); KH-P VB (4); KH-P VI (1)

- ***Coronilla*-Type**

Herbs or shrubs, 8 species of *Coronilla* are recorded in the Flora of Turkey.

Identification notes: elongated, linear, seeds with a circular cross section. The hilum is in the middle of the long axis.

Bibliography: Bojnanský and Fargašová 2007: 351

Plate 18 – d

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (1/56); KH-P IV (2/31); KH-P VB (1/9)

Count: KH-P II (1); KH-P III (3); KH-P IV (2); KH-P VB (1)

- ***Medicago* sp. and *Medicago*-Type** – medick and medick type

Annual or perennial herbs, rarely shrubs, comprising more than 30 species in the Flora of Turkey.

Identification notes: reniform to crescent-shaped seeds, light flattish and with a smooth surface. In addition to loosen seeds, fragments of the distinctive coiled pods are found – at times still containing seeds. Pods fragments are classified as *Medicago* sp., loose seeds as *Medicago*-Type.

Bibliography: van Zeist and Bakker-Heeres 1984: 225; Riehl 1999: 100-101

- *Medicago* type

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (3/25); KH-P II (17/41); KH-P III (31/56); KH-P IV (23/31); KH-P VA (7/10); KH-P VB (6/3); KH-P VI (1/2)

Count: KH-P I (9); KH-P II (91); KH-P III (174); KH-P IV (113); KH-P VA (25); KH-P VB (33); KH-P VI (2)

- *Medicago* sp. (pod)

Plate 18 – e, f

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (1/56); KH-P IV (1/31)

Count: KH-P II (2); KH-P III (2); KH-P IV (1)

- ***Medicago radiata*** – ray-podded medick

Annual herb, mainly growing in steppe habitat.

Identification notes: seed almost circular in outline, laterally compressed. Distinctive surface with ridges and grooves.

Bibliography: van Zeist and Bakker-Heeres 1984: 225

Plate 18 – g

Plant part: seed

Preservation: charred

Ubiquity: KH-P III (1/56); KH-P IV (1/31)

Count: KH-P III (1); KH-P IV (1)

- ***Melilotus*-Type** – sweet clover type

Annual or biennial herbs, 10 species are listed in the Flora of Turkey. Commonly growing in waste places, disturbed ground, fields.

Identification notes: ellipsoid, broadly ovoid, laterally flattened seed. Distinction from *Trifolium* based on a more elongated outline. This criterion is at times arbitrary.

Bibliography: Bojnanský and Fargašová 2007: 333-335

Photos: Pl.12–h

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (11/25); KH-P II (18/41); KH-P III (41/56); KH-P IV (19/31); KH-P VA (4/10); KH-P VB (5/9); KH-P VI (1/2)

Count: KH-P I (91); KH-P II (205); KH-P III (509); KH-P IV (90); KH-P VA (18); KH-P VB (10); KH-P VI (3)

- ***Trifolium*-Type** – clovers type

Annual or perennial herbs. More than 94 species of *Trifolium* are listed in the Flora of Turkey.

Identification notes: ellipsoid seeds, slightly flattened. The hilum is circular. The distinction from *Melilotus* is based on a rounder outline. This criterion is at times arbitrary.

Bibliography: Bojnanský and Fargašová 2007: 339-347

Plate 19 – a

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (5/25); KH-P II (16/41); KH-P III (34/56); KH-P IV (24/31); KH-P VA (7/10); KH-P VB (9/9); KH-P VI (1/2)

Count: KH-P I (61); KH-P II (97); KH-P III (452); KH-P IV (108); KH-P VA (20); KH-P VB (72); KH-P VI (1)

- ***Trigonella*-Type** – fenugreek genus type

Annual herbs. 49 species of *Trigonella* are recorded in the Flora of Turkey.

Identification notes: Oblong seeds, the upper and lower ends are truncated. Some specimens with tuberculate surface compare well with *Trigonella astroides* type, as described in van Zeist and Bakker-Heeres (1984: 226)

Bibliography: van Zeist and Bakker-Heeres 1984: 226

Plate 19 – b

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (5/25); KH-P II (12/41); KH-P III (31/56); KH-P IV (24/31); KH-P VA (8/10); KH-P VB (8/9); KH-P VI (1/2)

Count: KH-P I (173); KH-P II (91); KH-P III (190); KH-P IV (160); KH-P VA (71); KH-P VB (31); KH-P VI (2)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P III (1/56)

Count: KH-P III (1)

- ***Onobrychis* sp.** – sainfoin

Annual or perennial herbs, rarely shrubs. 46 species of *Onobrychis* are described in the Flora of Turkey.

Identification notes: the identification is based on the characteristic 1-seeded spiny pod. This taxon has been found only uncharred; it is likely a contaminant.

Bibliography: Bojnanský and Fargašová 2007: 353; Davis 1970: 585

Plate 19 – c

Plant part: pod with seed

Preservation: uncharred

Ubiquity: KH-P III (1/56)

Count: KH-P III (1)

FABACEAE (Leguminosae) – economic taxa

- ***Cicer arietinum*** – chickpea

Edible legume of well-known economic importance.

Identification notes: Large seed, circular to ellipsoid, with a distinct marked beak. Rugose surface

Bibliography: Neef et al 2012: 142-144

Plant part: seed

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

- ***Lens culinaris*** – lentil

Edible legume of well-known economic importance.

Identification notes: circular seeds, with a convex cross section and sharp margins. The hilum, not always preserved in archaeological specimens, is lanceolate.

Bibliography: Neef et al 2012: 156-165; Renfrew 1973: 113-115

Plate 19 – d, e

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (12/41); KH-P III (15/56); KH-P IV (4/31); KH-P VA (2/10); KH-P VB (3/9); KH-P VI (2/2)

Count: KH-P I (5); KH-P II (18.5); KH-P III (27.5); KH-P IV (12); KH-P VA (3); KH-P VB (6); KH-P VI (3)

- ***Pisum sativum*** – green pea

Edible legume of well-known economic importance.

Identification notes: spherical seeds. The hilum, not always preserved in archaeological specimens, is ovate, emerging from the seed surface.

Bibliography: Neef et al 2012: 175-177; Renfrew 1973: 110-112

Plate 19 – f

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (5/41); KH-P III (3/56)

Count: KH-P II (22); KH-P III (4.5)

- ***Vicia ervilia*** – bitter vetch

Edible legume of well-known economic importance.

Identification notes: angular seed, rounded with a triangular outline in the plane where the radicle is located. Small and oval hilum, which is not always preserved in archaeological specimens.

Bibliography: Neef et al 2012: 201-208; Renfrew 1973: 116-117

Plate 19 – g, h

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (7/25); KH-P II (14/41); KH-P III (18/56); KH-P IV (6/31); KH-P VA (3/10); KH-P VB (1/9);

KH-P VI (2/2)

Count: KH-P I (17.5); KH-P II (41.5); KH-P III (309); KH-P IV (9); KH-P VA (19); KH-P VB (2); KH-P VI (5)

- ***Vicia faba*** – broad bean

Edible legume of well-known economic importance.

Identification notes: broadly oval seed, having an almost circular cross section.

Bibliography: Neef et al 2012: 209-220; Renfrew 1973: 107-109

Plate 20 –a

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (3/56)

Count: KH-P II (2); KH-P III (3)

FAGACEAE

- **Cf. *Quercus* sp.** – oak (tentative)

Deciduous or evergreen trees, rarely shrubs.

Identification notes: a single specimen is tentatively identified as fragment of the involucre of an oak acorn.

Plate 20 – b

Plant part: cupule fragment

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

JUGLANDACEAE

- ***Juglans* sp.** – walnut

Fruit tree of well-known economic importance for its edible fruit.

Identification notes: the identification is based on fragments of the endocarp, showing the typical grooved surface. On the border of the halves, if preserved, the symmetric ridge is visible.

Bibliography: Neef et al 2012: 234-237; Renfrew 1973: 156

Plate 20 – c, d

Plant part: endocarp

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (3/56)

Count: KH-P II (2); KH-P III (3)

LAMIACEAE

- ***Ajuga*-Type** – bugleweed type

Annual to perennial herbs. 11 species of *Ajuga* are described in the Flora of Turkey.

Identification notes: obovate nutlets. A large hilum is present on the ventral side, the dorsal side is reticulated, with an elongated pattern. Based on size (either <1mm or >1mm) more than one species might be present. The distinction from *Teucrium*-Type is based on surface pattern.

Bibliography: Bojnanský and Fargašová 2007: 563

Plate 20 – e

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (11/41); KH-P III (12/56); KH-P IV (5/31); KH-P VB (3/9)

Count: KH-P I (17); KH-P II (24); KH-P III (20); KH-P IV (6); KH-P VB (4)

- ***Ajuga chamaepitys*** – yellow bugle

Perennial, biennial, or annual herb. 10 subspecies are described in the Flora of Turkey, covering an array of different environments.

Identification notes: ovoid-shaped seed. Reticulated surface, convex dorsal side, the ventral side is concave. A single specimen identified as *A. chamaepitys* is distinguished from *Ajuga*-Type on the basis of a distinctively more elongated shape.

Bibliography: Çizer 2015: 192

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

- ***Lallemianta*-Type** – dragon’s head type

Annual or perennial herb. 3 species recorded in the Flora of Turkey. A former economic importance of this genus has been proposed (Jones and Valamoti 2005).

Identification notes: single specimen. Elongated seed, with a triangular cross section and a rounded apex, the base is pointed showing a distinct hilum. The specimens resemble *Lallemianta iberica*, however it is smaller (length = 2.8 mm) than expected according to literature (4.2-4.8 mm).

Bibliography: Bojnanský and Fargašová 2007: 569; Jones and Valamoti 2005

Plate 20 – f

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P III (1/56); KH-P IV (1/31)

Count: KH-P III (1); KH-P IV (1)

- ***Mentha* sp.** – mints

Perennial, rarely annual, herbs; commonly growing in damp places. 7 species are recorded in the Flora of Turkey.

Identification notes: obovate to elliptic nutlets, having a pointed apex and a rounded base. The surface is finely reticulate.

Bibliography: Bojnanský and Fargašová 2007: 587

Plate 20 – g

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

- ***Nepeta* sp.** – catnip

Perennial, rarely annual, herb. 33 species of *Nepeta* are recorded in the Flora of Turkey. Catpins grow in various habitats, including woodlands, steppe, slopes, and fallow fields.

Identification notes: ovate to elliptic seed; slight flattish, dorsal side convex, ventral side flattened, both ends are rounded. On the ventral side indistinct ribs are observable.

Bibliography: Bojnanský and Fargašová 2007: 577

Plate 20 – h

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (4/41); KH-P III (6/56); KH-P IV (2/31)

Count: KH-P I (2); KH-P II (4); KH-P III (9); KH-P IV (2)

- ***Stachys*-Type** – hedgenettle type

Annual or perennial herbs; rarely dwarf shrubs. 72 species of *Stachys* are recorded in the Flora of Turkey.

Identification notes: broadly obovate nutlet; the ventral side is angular; the dorsal side is convex. The apex is rounded and with a pointed base.

Bibliography: Bojnanský and Fargašová 2007: 573-575

Plate 21 – a

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (1/56); KH-P IV (1/31)

Count: KH-P II (2); KH-P III (1); KH-P IV (1)

- ***Teucrium*-Type** – germanders type

Perennial (rarely annual or biennial) herbs, or small shrubs. 27 species of *Teucrium* are recorded in the Flora of Turkey, generally growing in oak shrub, open rocky and dry places, steppes, and as weed in cultivated fields.

Identification notes: obovate nutlets. A large hilum is present on the ventral side, the dorsal side is reticulated, with a circular pattern. The distinction from *Ajuga*-Type is based on the surface pattern.

Bibliography: Bojnanský and Fargašová 2007: 565

Plate 21 – b

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P III (2/56); KH-P IV (1/31); KH-P VA (3/10)

Count: KH-P I (2); KH-P III (2); KH-P IV (1); KH-P VA (6)

- ***Ziziphora* sp.** – Ziziphora genus

Annual and perennial herbs; 5 species of *Ziziphora* are described in the Flora of Turkey.

Identification notes: prolonged ovate nutlet, with a rounded apex and pointed base with a visible hilum. In well preserved specimens a reticulate surface is present. Identification on the species level might be possible based on surface ornamentation (Kaya and Dirmenci 2012).

Bibliography: Kaya and Dirmenci 2012

Plate 21 – c

Plant part: nutlet

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (5/41); KH-P III (12/56); KH-P IV (9/31); KH-P VA (3/10); KH-P VB (3/9)

Count: KH-P I (1); KH-P II (9); KH-P III (21); KH-P IV (20); KH-P VA (7); KH-P VB (7)

LILIACEAE

- ***Allium*-Type** – garlic genus type

Bulbous perennial herbs. More than 114 species are recorded in Turkey, with various ecology and distribution.

Identification notes: bulbils. The possible confusion with taxa other than Allium with similar tubers and bulbils cannot be excluded.

Bibliography: Medović 2005: 167

Plate 21 – d, e

Plant part: bulbile

Preservation: charred

Ubiquity: KH-P II (3/41); KH-P III (5/56); KH-P IV (1/31)

Count: KH-P II (5); KH-P III (10); KH-P IV (1)

- ***Bellevalia* sp.** – Bellevalia

Small to medium sized geophytes. 18 species of *Bellevalia* are described in the Flora of Turkey.

Identification notes: spherical to oval seeds, often irregularly shaped. Archaeological specimens are characterized by the presence of a distinct circular hole.

Bibliography: van Zeist and Bakker-Heeres 1985: 227

Plate 21 – f, g

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (5/41); KH-P III (6/56); KH-P IV (3/31); KH-P VA (1/10)

Count: KH-P I (1); KH-P II (5); KH-P III (21); KH-P IV (3); KH-P VA (1)

- ***Ornithogalum* sp.** – Star-of-Bethlehem

Small to medium sized geophytes. 18 species of *Ornithogalum* are described in the Flora of Turkey.

Identification notes: distinguished from *Bellevalia* by the presence of a reticulate surface.

Bibliography: van Zeist and Bakker-Heeres 1985: 227

Plate 21 – h

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (3/41); KH-P III (5/56); KH-P IV (4/31)

Count: KH-P II (8); KH-P III (7); KH-P IV (5)

LINACEAE

- ***Linum usitatissimum*** – flax

Plant of a well-known economic importance; used for oil or textile production.

Identification notes: large oval seed; lenticular, with a beak at one end. A fine reticulate surface is observed.

Bibliography: Renfrew 1973: 107-109

Plate 22 – a

Plant part: seed

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

MALVACEAE

- ***Malva* sp.** – mallows

8 species of *Malva* are recorded in the Flora of Turkey, commonly growing in waste and open places.

Identification notes: subcircular seeds with a wedge-shaped cross section. The surface is smooth. Because of the lack of specimens with pericarp preserved, the identification to the species level was not aimed.

Bibliography: Bojnanský and Fargašová 2007: 375-377

Plate 22 – b

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (2/41); KH-P III (8/56); KH-P IV (3/31); KH-P VA (1/10); KH-P VB (1/9)

Count: KH-P I (9); KH-P II (2); KH-P III (20); KH-P IV (4); KH-P VA (1); KH-P VB (1)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P III (1/56)

Count: KH-P III (1)

MORACEAE

- ***Ficus carica*** – common fig

Fruit tree of well-known economic importance for its edible fruit.

Identification notes: roundish small seed, slightly pointed at the hilum end, with a rounded apex. Some specimens, atypically flattened, are more cautiously identified as cf. *Ficus carica*.

Bibliography: Renfrew 1973: 134-136

Plate 22 – c, d

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P IV (1/31); KH-P VB (3/9)

Count: KH-P II (3); KH-P IV (1); KH-P VB (3)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P VB (1/9)

Count: KH-P VB (2)

PAPAVERACEAE

- ***Fumaria* sp.** – fumitory

Annual herbs. 15 species of *Fumaria* are described in the Flora of Turkey, of which *F. densiflora* and *F. cilicia* in central Anatolia.

Identification notes: roughly circular seeds, with a keel around the circumference. The apex is rounded with two distinctive elliptic depressions.

Bibliography: Bojnanský and Fargašová 2007: 171

Plate 22 – e

Plant part: fruit

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (3/41); KH-P III (12/56); KH-P IV (4/31)

Count: KH-P I (2); KH-P II (31); KH-P III (14); KH-P IV (4)

- ***Glaucium* sp.** – horned poppy

Annual, biennial, or perennial herbs. 7 species of *Glaucium* are recorded in the Flora of Turkey. This taxon commonly grows in dry hills, hillsides, and fields.

Identification notes: semicircular to reniform seed; the dorsal side is convex; the ventral side is straight. The surface is markedly reticulated.

Bibliography: Bojnanský and Fargašová 2007: 167

Plate 22 – f, g, h

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (4/41); KH-P III (7/56); KH-P IV (2/31)

Count: KH-P I (1); KH-P II (4); KH-P III (23); KH-P IV (2)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P I (1/25); KH-P II (2/41); KH-P III (10/56); KH-P IV (2/31)

Count: KH-P I (1); KH-P II (2); KH-P III (182); KH-P IV (3)

- ***Papaver* spp.** – poppies

Annual herbs. 36 species of *Papaver* are described in the Flora of Turkey. They commonly grow in rocky slopes, meadows, and limestone screes.

Identification notes: reniform seed, with a convex dorsal side and a concave ventral side. The surface is reticulated. Identification to the species level was not aimed, due to a limited comparative collection and the strong similarities in seed anatomy between the members of this genus.

Bibliography: Bojnanský and Fargašová 2007: 163-167

Plate 23 – a, b

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (3/41); KH-P III (2/56); KH-P IV (1/31); KH-P VA (1/10); KH-P VB (1/9)

Count: KH-P I (1); KH-P III (9); KH-P III (3); KH-P IV (1); KH-P VA (1); KH-P VB (1)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P II (2/41); KH-P III (2/56)

Count: KH-P II (2); KH-P III (3)

PINACEAE

- ***Abies* sp.** – fir

Conical evergreen tree. Two species of fir are naturally occurring in Anatolia, on a phytogeographic basis very likely an attribution to *A. cilicica*.

Identification notes: linear-oblong leaves, stomata visible on the bottom side. The proximal end, in proximity of the attachment scar, is twisted; the distal end is rounded with a central dent.

Bibliography: Davis 1965: 67-68

Plate 23 – c, d

Plant part: needle

Preservation: charred

Ubiquity: KH-P II (2/41)

Count: KH-P II (19)

PLANTAGINACEAE

- ***Plantago* spp.** – plantains

Annual or perennial terrestrial herbs or dwarf shrubs. 20 species of plantains are listed in the Flora of Turkey.

Identification notes: ellipsoid seed; the dorsal side is convex, the ventral side is flattened and with a large furrow containing the oval/circular hilum.

Bibliography: Bojnanský and Fargašová 2007: 639-640

Plate 23 – e

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (25); KH-P II (4/41); KH-P III (7/56); KH-P IV (9/31); KH-P VB (2/9)

Count: KH-P I (6); KH-P II (9); KH-P III (18); KH-P IV (12); KH-P VB (2)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P III (1/56)

Count: KH-P III (1)

POACEAE (Graminaceae) – non-economic taxa

Poaceae (grasses) produce a single seeded fruit having the pericarp tightly fused with the seed, a type of fruit known as caryopsis (grain) (Cappers and Bekker 2013: 194). The family of the Poaceae is composed by more than 142 genera described in the Flora of Turkey. Although an attempt to classify and describe the seed anatomy of Near Eastern grasses is present (Nesbitt 2006), the reference material is often too limited to allow a certain identification to the genus level. Accordingly, in this work only the main Poaceae genera/species are identified, while other grass grains are identified to the family level.

- ***Aegilops* sp.** – goat grasses

Annual grass. 15 species of goat greases are described in the Flora of Turkey. The commonly grow on stony slopes, dry grassland, and weedy places.

Identification notes: elliptic grains, dorso-ventrally compressed. The ventral side is flat, with a narrow groove.

Bibliography: Nesbitt 1996: 92-93; van Zeist and Bakker-Heeres 1985: 219

Plate 23 – f, g

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

Plant part: glume base

Preservation: charred

Ubiquity: KH-P II (5/41); KH-P IV (1/31)

Count: KH-P II (7); KH-P IV (3)

- ***Bromus* sp.** – bromes

Annual grass. 36 species of *Bromus* are recorded in the flora of Turkey, occurring in various types of habitats – e.g., meadows, waste places, roadsides, cultivated fields.

Identification notes: elongated, strongly flattened, grains. The grains are tapering at each side, the scutellum is V-shaped.

Bibliography: Nesbitt 1996: 80-82

Plate 23 – h

Plate 24 – a

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (5/25); KH-P II (11/41); KH-P III (19/56); KH-P IV (9/31); KH-P VA (1/10); KH-P VB (2/9)

Count: KH-P I (37); KH-P II (26); KH-P III (125); KH-P IV (12); KH-P VA (5); KH-P VB (2)

- ***Eremopyrum*-Type**

Annual grass, with 4 species described in the Flora of Turkey. *E. bonaepartis* is a common weed in central Anatolian fields.

Identification notes: Elongated caryopsis. The ventral side is grooved and with a long linear furrow. The dorsal side is with striations and ridged. As noted by Nesbitt (1996: 88), grains of *Eremopyrum* and *Agropyron* caryopsis are identical. The identification is, thus, considered as type.

Bibliography: Nesbitt 1996: 88

Plate 24 – b, c

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (2/41); KH-P III (7/56); KH-P IV (2/31)

Count: KH-P I (2); KH-P II (2); KH-P III (25); KH-P IV (6)

- ***Festuca* sp.** – fescues

Cespitose or rhizomatous perennial grasses. 44 species of *Festuca* are described in the Flora of Turkey. *Festuca* grows in several habitats, including woodland, shrubs, meadows, riverside.

Identification notes: dorsally compressed caryopsis, with pointed proximal end and truncated/rounded distal end. The ventral side is grooved, with a long wide furrow. The hilum is triangular. *Festuca* is distinguished from *Hordeum* by the presence of the V-shaped palea grooves; distinction from *Lolium* is based on dimensions: *Festuca* grains are significantly smaller (~3 mm).

Bibliography: Nesbitt 1996: 53-54

Plate 24 – d

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P III (6/56); KH-P IV (2/31)

Count: KH-P III (20); KH-P IV (2)

- ***Hordeum* sp. (wild)** – barley (wild)

Annual or perennial grasses. 6 species of wild *Hordeum* are recorded in the Flora of Turkey.

Identification notes: The presence of wild barley, documented by the typical spindle-shaped grains, is further confirmed by rachis fragments with wild-type disarticulation scars.

Bibliography: Nesbitt 1996: 85-87

Plate 24 – e, f

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (8/41); KH-P III (10/56); KH-P IV (6/31); KH-P VB (3/9)

Count: KH-P I (1); KH-P II (143); KH-P III (25); KH-P IV (10); KH-P VB (3)

Plant part: rachis fork

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (1/41); KH-P III (2/56); KH-P IV (2/31)

Count: KH-P I (2); KH-P II (9); KH-P III (2); KH-P IV (2)

- ***Lolium* sp.** – ryegrass

Annual, biennial, or perennial grasses. 6 species of *Lolium* are recorded in the Flora of Turkey, including *L. temulentum*, a common weed.

Identification notes: *Lolium* caryopses are dorsal-ventrally compressed; the ventral side is flat; the dorsal side is slightly domed. The apex is rounded or truncated, and the greatest width is in the middle of the grain. V-shaped palea grooves are present on the ventral side. As discussed by Nesbitt (1996: 54-56) and Riehl (1999: 97), the distinction of *Lolium* to the species level might be further complicated by the adaptation of this genus to crops over time. Considering the limited number of specimens from N-KH, the identification to the species level was not aimed.

Bibliography: Nesbitt 1996: 54-56

Plate 24 – g, h

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (2/41); KH-P III (3/56); KH-P IV (4/31); KH-P VA (5); KH-P VB (1/9)

Count: KH-P I (5); KH-P II (2); KH-P III (3); KH-P IV (5); KH-P VA (6); KH-P VB (1)

- ***Micropyrum*-Type**

Annual grass. *M. tenellum* is the only species of the genus *Micropyrum* recorded in the Flora of Turkey; most common habitats are dry open places.

Identification notes: dorsally compressed caryopsis; the ventral side is grooved, with long V-shaped furrow; the dorsal side is with striations, the embryo is small.

Bibliography: Nesbitt 1996: 56-57

Plate 25 – a

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P IV (1/31)

Count: KH-P II (1); KH-P IV (1)

- ***Phalaris*-Type** – reed canary grass genus

Annual or perennial grasses. 8 species are recorded in the Flora of Turkey.

Identification notes: strongly laterally compressed caryopsis. The narrow dorsal side is ridged and with a medium-sized embryo. The furrow on the ventral side is short.

Bibliography: Nesbitt 1996: 74

Plate 25 – b

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (3/25); KH-P II (2/41); KH-P III (4/56); KH-P IV (3/31)

Count: KH-P I (12); KH-P II (5); KH-P III (30); KH-P IV (4)

- ***Poa bulbosa*** – bulbous bluegrass

Perennial grass. Widespread in Anatolia, growing in steppe, dry grassland, rocky slopes, phrygana, and cliffs.

Identification notes: identified based on the highly diagnostic florets.

Bibliography: Bojnanský and Fargašová 2007: 873

Plate 25 – c, d

Plant part: floret

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (4/56); KH-P IV (2/31)

Count: KH-P II (5); KH-P III (12); KH-P IV (5)

- ***Setaria* viridis/*verticillata*-Type**– bristle grasses

Annual or perennial grasses. 4 species of wild *Setaria* are recorded in the Flora of Turkey. They commonly grow in disturbed ground and waste places.

Identification notes: dorsally compressed grain; the long embryo is visible on the dorsal side. Because of the limited number of specimens from the N-KH assemblage, an identification to the species level was not aimed.

Bibliography: Nesbitt 1996: 104

Plate 25 – e

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P III (1/56)

Count: KH-P III (1)

- ***Stipa* sp.** – needle grasses

Perennial, rarely annual, grasses. 14 species of *Stipa* are recorded in the Flora of Turkey; commonly grow in dry-sandy places, stony slopes, meadows, and upland steppe.

Identification notes: elongated caryopsis, with circular cross section. A long linear furrow is present on the ventral side. The dorsal side is with a characteristic horse-shoe shaped embryo.

Bibliography: Nesbitt 1996: 50-51

Plate 25 – f, g

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P II (9/41); KH-P III (12/56); KH-P IV (3/31); KH-P VA (2); KH-P VB (2); KH-P VI (1/2)

Count: KH-P II 13); KH-P III (22); KH-P IV (4); KH-P VA (3); KH-P VB (2); KH-P VI (1)

- ***Taeniatherum caput-medusae*** – medusa head grass

Annual grass, widespread in Anatolia. It commonly grows in steppe, waste place, fields.

Identification notes: the identification is based on the highly diagnostic spikelet bases.

Bibliography: Fairbairn et al. 2007: 473-474

Plate 25 – h

Plant part: glume base

Preservation: charred

Ubiquity: KH-P I (1/25)

Count: KH-P I (1)

POACEAE (Graminaceae) – economic taxa

- ***Hordeum vulgare* ssp. *distichon*** – two-rowed common barley

Together with free-threshing wheat, 2-rowed barley is the most common cereal in the N-KH record.

Identification notes: Domesticated barley is abundantly attested by both grains and rachis fragments. The identification of the rachis fragments as 2-row barley (ssp. *distichon*) follows the criteria outlined by Charles et al. 2010. Particular attention is given to the thickness of the stalks of the two later florets and to the shape of the rachis fragment on the adaxial side in top view. In 2-rowed barley the lateral florets are not fertile, with bases having a significant lower diameter than the central (fertile) floret. Observed from the top, both the adaxial and abaxial sides of the internode are either flattened or slightly convex. Poorly preserved rachis specimens were identified as *Hordeum vulgare* s.l. The overwhelming majority of well-preserved barley grains are characterized by an angular cross section, and a wide and shallow ventral furrow – characters diagnostic of the hulled barley varieties (Jacomet 2006). Only single grains are attributed to the naked form.

Bibliography: Charles et al. 2010; Neef et al. 2012: 374-387; Jacomet 2006

Plate 26 – g, h

Plant part: rachis

Preservation: charred

Ubiquity: KH-P I (12/25); KH-P II (13/41); KH-P III (15/56); KH-P IV (12/31); KH-P VA (7/10); KH-P VB (1/9)

Count: KH-P I (201); KH-P II (150); KH-P III (128); KH-P IV (21); KH-P VA (21); KH-P VB (1)

- ***Hordeum vulgare* ssp. *vulgare*** – six-rowed common barley

6-rowed barley is only rarely documented at N-KH. See notes under *Hordeum vulgare* ssp. d*istichon*.

Identification notes: the identification of 6-rowed barley in the N-KH assemblage is based on rachis fragments, following the criteria outlined in Charles et al 2010. Rachis fragments identified as 6-row barley are characterized by large diameters of the bases of the lateral (fertile) florets (i.e., ~ to the central floret stalk) diameter. Observed from the top, both the adaxial and abaxial sides of the internode are concave. The marginal role of 6-rowed barley inferred by rachis fragments is further corroborated by the dominance in the N-KH barley assemblage of straight grains.

Bibliography: Charles et al. 2010; Neef et al. 2012: 390-398; Jacomet 2006

Plate 26 – e, f

Plant part: rachis

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (1/41); KH-P III (1/56); KH-P IV (1/31); KH-P VA (2/10)

Count: KH-P I (1); KH-P II (6); KH-P III (1); KH-P IV (1); KH-P VA (3)

- ***Hordeum vulgare* undif.** –domesticated barley undif.

See notes under *Hordeum vulgare* ssp. d*istichon*.

Plate 26 – b, c

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (21/25); KH-P II (37/41); KH-P III (50/56); KH-P IV (24/31); KH-P VA (10/10); KH-P VB (8/9); KH-P VI (2/2)

Count: KH-P I (126); KH-P II (213); KH-P III (406); KH-P IV (248); KH-P VA (107); KH-P VB (70); KH-P VI

(10)

- ***Hordeum vulgare* var. *nudum*** –naked barley

See notes under *Hordeum vulgare* ssp. *distichon*.

Photos: Pl.20–d

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P IV (1/31)

Count: KH-P II (2); KH-P IV (8)

- ***Triticum monococcum*** – einkorn

Einkorn is extremely rare in the N-KH assemblage. It cannot be excluded that the sporadic kernels identified as *T. monococcum* originated from plants of einkorn growing as weed in free-threshing wheat fields.

Identification notes: grains identified as *T. monococcum* are laterally compressed and spindle-shaped. In later view, the ventral outline is convex, and the highest point is in the center of the grain. No rachis fragments attributable to *T. monococcum* are found.

Bibliography: Neef et al. 2012: 447-452; Jacomet 2006

Plate 27 – a

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (2/25)

Count: KH-P I (2)

- ***Triticum dicoccum*** – emmer

Emmer is extremely rare in the N-KH assemblage. It cannot be excluded that the sporadic kernels identified as *T. dicoccum* originated from plants of emmer growing as weed in free-threshing fields.

Identification notes: Grains are significantly narrower than free-threshing wheat. In later view, the ventral side is relatively flattened. The cross section is triangular, sometimes asymmetric (roof-like). The marginal role of hulled wheat verities is confirmed by the extreme rarity of emmer rachis fragments.

Bibliography: Neef et al. 2012: 461-486; Jacomet 2006

Plate 27 – b, c

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (1/25)

Count: KH-P I (1)

Plant part: spikelet fork

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (4/41); KH-P III (7/56); KH-P IV (2/31); KH-P VA (1/10)

Count: KH-P I (3); KH-P II (4); KH-P III (11); KH-P IV (2); KH-P VA (4)

- ***Triticum aestivum/durum*** – bread/macaroni wheat

Together with 2-rowed barley, free-threshing wheat is the most common cereal in the N-KH record.

Identification notes: *T. aestivum/durum* grains are characterized by having rounded flanks. These grains are shorter and larger than emmer. The distinction between *T. durum* and *T. aestivum* based on charred caryopsis is highly problematic (e.g., Jacomet 2006). In this work, the identification of free-threshing wheat to the ploidy level is based exclusively on rachis fragments.

Bibliography: Neef et al. 2012: 487-533; Jacomet 2006

Plate 27 – d, e

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (20/25); KH-P II (32/41); KH-P III (49/56); KH-P IV (27/31); KH-P VA (10/10); KH-P VB (8/9); KH-P VI (2/2)

Count: KH-P I (102); KH-P II (562); KH-P III (643); KH-P IV (253); KH-P VA (110); KH-P VB (69); KH-P VI (20)

- ***Triticum aestivum*** – bread wheat

In almost all the instances in which the identification to the ploidy level is possible (see below), the specimens of free-threshing wheat from N-KH are identified as bread wheat (*T. aestivum*).

Identification notes: the identification of free-threshing wheat to the ploidy level is based in this work exclusively on chaff, following the identification criteria summarized by Jacomet (2006). The overwhelming majority of the well-preserved rachis fragments show striations near the outer edge of the abaxial side of the rachis internode, which is regarded as reliable criteria for the identification of the hexaploid type (*T. aestivum*) (Jacomet 2006; Nesbitt et al. 2017: 39-40). The identification is further corroborated by the shield shape of the internodes, and the presence of reduced swellings (bulges) under the glume bases (Jacomet 2006). The identification to the ploidy level was not conducted in poorly-preserved specimens, especially in the instances in which only the rachis node was preserved. A limited number of wheat internodes are characterized by a 'thick' and squared cross section; these remains are identified as *T. aestivum/durum* basal rachis fragments (Percival 1974: 105-109). Tetraploid wheat (*T. durum*) is tentatively identified only on a very minimal number of the specimens from N-KH so far analyzed.

Bibliography: Neef et al. 2012: 511-523; Jacomet 2006: 34-37

Plate 27 – f, g, h

Plant part: rachis

Preservation: charred

Ubiquity: KH-P I (6/25); KH-P II (17/41); KH-P III (20/56); KH-P IV (3/31); KH-P VA (4/10); KH-P VB (2/9)

Count: KH-P I (20); KH-P II (282); KH-P III (72); KH-P IV (15); KH-P VA (17); KH-P VB (3)

- ***Triticum durum*** –macaroni wheat

See notes under *Triticum aestivum*.

Plate 28 – c, d

Plant part: rachis

Preservation: charred

Ubiquity: KH-P III (1/56)

Count: KH-P III (2)

- ***Secale cereale*** – rye

Rye appears as a minor cereal in the N-KH record, documented especially in the Late Hellenistic and

Seljuk/Ottoman levels.

Identification notes: grains are 'bullet-shaped', having the distal end truncated and the proximal end, with a pointed and long embryo. Longitudinal ribs are clearly visible, providing a further reliable criterion for their identification (Nesbitt 2017: 46; Körber-Grohne and Piening 1980). Rye is further attested by rachis fragments, which are characterized by straight sides and the presence of the bases of the narrow glumes on the sides of the internodes (Jacomet 2006). The disarticulation scar of the rachis fragments confirms the domesticated status of the rye remains from N-KH.

Bibliography: Neef et al. 2012: 425-429; Nesbitt 2017: 46; Körber-Grohne and Piening 1980; Jacomet 2006: 49

Plate 28 – e, f, g, h

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (8/25); KH-P II (3/41); KH-P III (4/56)

Count: KH-P I (16); KH-P II (38); KH-P IV (5)

Plant part: rachis

Preservation: charred

Ubiquity: KH-P I (6/25); KH-P II (2/41); KH-P III (1/56)

Count: KH-P I (26); KH-P II (8); KH-P III (1)

- ***Panicum miliaceum*** – broomcorn millet

Broomcorn millet is a minor cereal in the N-KH record.

Identification notes: short panicoid grains. The distal end is relatively pointed, the proximal end is blunt. The embryo is short, usually less than half the length of the grain. The edges of the scutellum are divergent.

Bibliography: Neef et al. 2012: 418-421; Nesbitt and Summers 1988; Jacomet 2006: 55-57

Plate 29 – a, b

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (4/41); KH-P III (3/56); KH-P IV (2/31); KH-P VA (1/10); KH-P VB (5/9)

Count: KH-P I (2); KH-P IV (4); KH-P III (4); KH-P IV (4); KH-P VA (5); KH-P VB (28)

- ***Setaria italica*** – foxtail millet

Foxtail millet is a minor cereal in the N-KH record.

Identification notes: *Setaria italica* is distinguished from *Panicum miliaceum* on the basis of a more rounded shape (blunted distal end) and a longer embryo (exceeding 65% of the grain length). Furthermore, the edges of the scutellum in *Setaria* are parallel rather than divergent (*Panicum*).

Bibliography: Neef et al. 2012: 430-432; Nesbitt and Summers 1988; Jacomet 2006: 55-57

Plate 29 – c

Plant part: caryopsis

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (2/41); KH-P III (3/56)

Count: KH-P I (3); KH-P II (3); KH-P III (3)

POLYGONACEAE

- ***Polygonum* spp.** – knotweeds

Annual, perennial or suffrutescent herbs or climbers. In the earlier taxonomy the genus comprised taxa which were later reclassified as self-standing genera (e.g., *Persicaria*, *Fallopia*). In this work, following the Flora of Turkey, we refer to *Polygonum* spp. in its former broader original sense. 27 species of *Polygonum* are described in the Flora of Turkey.

Identification notes: trigonous achenes with rounded margins. The surface is finely textured. These specimens are distinguished from *Rumex* based on their more rounded margins. *Polygonum* achenes might superficially resemble Cyperaceae, the two taxa can be distinguished according to seed orientation, type of ornamentation, and position of the embryo in the seed. Some poorly preserved specimens and loose endosperms are attributed to the general category Cyperaceae/Polygonaceae.

Bibliography: Bojnanský and Fargašová 2007: 123-127

Plate 29 – d, e

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (3/41); KH-P III (9/56); KH-P IV (9/31); KH-P VA (1/10); KH-P VB (1/9)

Count: KH-P II (9); KH-P III (56); KH-P IV (14); KH-P VA (5); KH-P VB (2)

- ***Polygonum aviculare*-Type** – prostrate knotweed type

Polygonum aviculare sensu strictu might be aggregate together with *P. arenastrum* and other closely related species (Davis 1967: 277). In this work we refer to this taxon in this broader sense. *P. aviculare* is a cosmopolitan weed.

Identification notes: trigonous to ovate achenes, with a triangular cross section. The apex is pointed, slightly asymmetric. In some well-preserved specimens, part of the perianth is preserved at the base of the seed

Bibliography: Bojnanský and Fargašová 2007: 125

Plate 29 – f

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (9/41); KH-P III (14/56); KH-P IV (2/31); KH-P VB (2/9)

Count: KH-P I (6); KH-P II (18); KH-P III (43); KH-P IV (2); KH-P VB (2)

- ***Polygonum convolvulus*** –black bindweed

Scrambling perennial. This species commonly grows in waste places and tilled grounds.

Identification notes: trigonous achenes, pointed at both ends. The surface is ornamented with papillae distributed in longitudinal rows.

Bibliography: Bojnanský and Fargašová 2007: 125-127

Plate 29 – g

Plant part: achene

Preservation: charred

Ubiquity: KH-P III (4/56); KH-P IV (1/31); KH-P VI (1/2)

Count: KH-P III (9); KH-P IV (1); KH-P VI (1)

- ***Persicaria*-Type** – redshank genus type

The genus *Persicaria* includes species formerly attributed to the genus *Polygonum*. See identification notes for further clarifications.

Identification notes: with *Persicaria*-Type, I am referring to oval achenes with pointed apex. One of the sides of the achene is flat, the other slightly domed. The overall anatomy closely recalls *P. lapathifolia*. The specimens from N-KH are, however, significantly smaller (~ 1.4 mm) than the ones available in the reference materials (~ 2-3 mm).

Bibliography: Bojnanský and Fargašová 2007: 123

Plate 29 – h

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (3/25); KH-P I (1/41); KH-P III (1/56); KH-P VB (1/9)

Count: KH-P I (3); KH-P I (1); KH-P III (1); KH-P VB (1)

- ***Rumex* spp.** – docks

Annual or perennial herbs. 23 species of *Rumex* are recorded in the Flora of Turkey, commonly growing in habits such as arable fields, slopes, hillsides, meadows, roadsides, waste places, and marshes.

Identification notes: trigonous achenes with sharp edges. Based on differences in outline, more than one species is present in the N-KH assemblage. The identification to the species level was not aimed due to poor preservation and lack of adequate comparative materials.

Bibliography: Bojnanský and Fargašová 2007: 115-121

Plate 30 – a, b, c

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (15); KH-P III (12); KH-P IV (2/31); KH-P VB (3/9)

Count: KH-P I (4); KH-P II (82); KH-P III (41); KH-P IV (2); KH-P VB (4)

Plant part: achene

Preservation: uncharred

Ubiquity: KH-P IV (3/31)

Count: KH-P IV (8)

PORTULACACEAE

- ***Portulaca oleracea*** – common purslane

Portulaca is a monospecific genus in Turkey. *P. oleracea* is an annual herb, commonly growing in cultivated fields and waste places.

Identification notes: triangular to rounded seeds, lateral compressed and with a distinct beak. The surface is verrucose.

Bibliography: Bojnanský and Fargašová 2007: 47

Plate 30 – d, e

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (2/41); KH-P III (3/56); KH-P IV (5/31); KH-P VA (1/10); KH-P VI (1/2)

Count: KH-P I (7); KH-P II (3); KH-P III (7); KH-P IV (5); KH-P VA (1); KH-P VI (1)

POTAMOGETONACEAE

- ***Potamogeton* sp.**– pondweed

Aquatic plants. 14 species described in the Flora of Turkey

Identification notes: Oval achene, slightly compressed. A short knob is present on the apex.

Bibliography: Bojnanský and Fargašová 2007: 767-771

Plate 30 – f

Plant part: fruit

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P IV (1/31)

Count: KH-P II (1); KH-P IV (1)

PRIMULACEAE

- ***Androsace maxima*** – rock jasmine

Erected annual herb; according to the Flora of Turkey it grows on limestone or igneous rocks, gravel sand or clay steppe, open pine woods, cultivated or fallow fields.

Identification notes: obovoid/oval seeds, triangular in cross section and with both ends rather pointed. The surface is irregularly waved by prominent transversal ridges and grooves.

Bibliography: Bojnanský and Fargašová 2007: 47; van Zeist and Bakker-Heeres 1985: 229

Plate 30 – g

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (8/41); KH-P III (17/56); KH-P IV (5/31); KH-P VA (1/10)

Count: KH-P I (6); KH-P II (16); KH-P III (27); KH-P IV (9); KH-P VA (1)

RANUNCULACEAE

- ***Adonis* sp.** – pheasant's-eye genus

Annual or perennial herbs. 9 species of *Adonis* are described in the Flora of Turkey. *A. aestivalis* and *A. flammea* are distributed in central Anatolia, growing in cultivated or fallow fields and disturbed steppes

Identification notes: ovate achene, with a keel on the margin. The surface is rugose-reticulate.

Bibliography: Bojnanský and Fargašová 2007: 155; van Zeist and Bakker-Heeres 1985: 229

Plate 30 – h

Plate 31 – a

Plant part: achene

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (9/41); KH-P III (19/56); KH-P IV (6/31); KH-P VA (1/10); KH-P VB (1/9)

Count: KH-P I (2); KH-P II (13); KH-P III (50); KH-P IV (7); KH-P VA (1); KH-P VB (1)

- ***Ceratocephalus falcatus***

Annual herb. Widespread in central Anatolia, generally growing in open places.

Identification notes: achene having a long distinctive beak. in the specimens from N-KH the beak is curved rather than straight, a character diagnostic of *C. falcatus*.

Bibliography: Davis 1966: 197-198

Plate 31 – b

Plant part: achene

Preservation: charred

Ubiquity: KH-P III (11/56); KH-P IV (2/31)

Count: KH-P III (14); KH-P IV (2)

- ***Ranunculus* sp.** –buttercup

Annual or perennial herbs, terrestrial or aquatic. Very large genus, with 78 species described in the Flora of Turkey.

Identification notes: obovate-elliptic achene, dorsally compressed. The apex narrows into a distinct short and curved beak. The surface is finely reticulated. Because of the number of species to be considered, which are not adequately covered in availlable reference materials, the identification is kept at the genus level.

Bibliography: Bojnanský and Fargašová 2007: 145-155

Plate 31 – c

Plant part: achene

Preservation: charred

Ubiquity: KH-P III (3/56)

Count: KH-P III (3)

RESEDACEAE

- ***Reseda lutea*-Type** – yellow mignonette Type

Annual to perennial herb, widespread in Anatolia. *R. lutea* commonly grows on roadsides, fields, ditches, and open stony hill sides.

Identification notes: curved seed, with a small incision at the base. In well preserved specimens the surface is finely areolate to scalariform. The identification is regarded as type because of the impossibility to access other *Reseda* species in the available modern comparative material.

Bibliography: Bojnanský and Fargašová 2007: 173

Plate 31 – d

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (2/41)

Count: KH-P I (23); KH-P II (8)

ROSACEAE

- ***Crataegus* sp.** – hawthorns

Deciduous trees or shrubs. Genus of economic importance, the fleshy fruits from both wild and cultivated varieties are consumed. 17 species described in the Flora of Turkey.

Identification notes: pyrenes ellipsoid to spherical, with one side curved and two sides forming an angle. The specimens from N-KH closely recall *C. azeruolus* (Neef et al. 2012: 566). An anatomic study of Anatolian hawthorns is, however, necessary in order to confirm the identification to the species level.

Bibliography: Bojnanský and Fargašová 2007: 293-297; Neef et al. 2012: 546-566

Plate 31 – e

Plant part: pyrene

Preservation: charred

Ubiquity: KH-P II (4/41); KH-P III (3/56); KH-P IV (1/31); KH-P VA (2/10); KH-P VB (1/9)

Count: KH-P II (17); KH-P III (3); KH-P IV (1); KH-P VA (18); KH-P VB (1)

- ***Prunus* sp.** – plums genus

Deciduous trees or shrubs. Genus of economic importance, the fleshy fruits from both wild and cultivated varieties are consumed.

Identification notes: fragments of endocarps, identified to the genus level as *Prunus*. The specimens are too fragmented to allow a more precise identification.

Bibliography: Bojnanský and Fargašová 2007: 279-283

Plate 31 – f

Plant part: endocarp

Preservation: charred, uncharred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

- ***Pyrus/Malus*** – pear/apple

Deciduous trees or shrubs. Both genera are of economic importance, the fleshy fruits from both wild and cultivated varieties are consumed.

Identification notes: prolonged obovoid seeds, rounded at the apex and pointed at the base. *Pyrus* is generally distinguished from *Malus* based on a more slender and longer shape, and the presence of an oblique hilum. The single specimen from N-KH compare better with *Pyrus*, the identification is, however, kept at a higher taxonomic level because of its singular occurrence.

Bibliography: Renfrew 1973: 136-141

Plate 31 – g

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

- ***Rubus sp.*** – brambles

Shrubs or rarely perennial herbs. Genus of economic importance, the fleshy fruits from both wild and cultivated varieties are consumed. 9 species of *Rubus* are described in the Flora of Turkey.

Identification notes: half-circular stone with a distinct reticulate surface pattern.

Bibliography: Bojnanský and Fargašová 2007: 249-253

Plate 31 – h

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P VA (1/10)

Count: KH-P II (1); KH- P VA (1)

- ***Sanguisorba sp.*** – burnet

Perennial herb. 3 species of *Sanguisorba* are described in the flora of Turkey: *S. armena*, *S. officinalis*, *S. minor*.

Identification notes: achenes are ovoid, four-angled and with an undulate margin. The surface is reticulate.

Bibliography: Bojnanský and Fargašová 2007: 273-275

Plate 32 – a

Plant part: fruit

Preservation: charred

Ubiquity: KH-P III (1/56)

Count: KH-P III (2)

RUBIACEAE

- ***Asperula arvensis/orientalis*-Type** – blue/annual woodruff type

A. arvensis is widespread in Anatolia, growing in open grounds, fields, and waste places. *A. orientalis* commonly grows on steppe, oak scrub, bare ground, fields.

Identification notes: oval shaped seed. In the central large hole, a prominent middle ridge is present. These specimens closely match *A. arvensis/orientalis*, the identification is considered as type due to the large number of *Asperula* species attested in Anatolia (41), which are not entirely accessible in the available reference materials.

Bibliography: Bojnanský and Fargašová 2007: 495-497

Plate 32 – b

Plant part: fruit

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (5/41); KH-P III (8/56); KH-P IV (1/31); KH-P VA (2/10); KH-P VB (3/9); KH-P VI (2/2)

Count: KH-P I (67); KH-P II (11); KH-P III (10); KH-P IV (1); KH-P VA (2); KH-P VB (4); KH-P VI (2)

- ***Asperula* sp.** – woodruff

Low shrubs, perennial, or annual herbs. 41 species are described in the Flora of Turkey

Identification notes: The specimens identified as *Asperula* sp, are characterized by a central hole with a prominent ridge in the middle. The seed outline, however, does not match the *A. arvensis/orientalis* type previously described.

Bibliography: Bojnanský and Fargašová 2007: 497-503

Plate 32 – c

Plant part: fruit

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (1/41); KH-P III (4/56); KH-P IV (2/31); KH-P VB (2/9)

Count: KH-P I (1); KH-P II (1); KH-P III (7); KH-P IV (2); KH-P VB (2)

- ***Galium* sp.** – bedstraw

Perennial or annual herbs, 101 species of *Galium* are recorded in the Flora of Turkey.

Identification notes: spherical/sub-spherical seeds, characterized by a distinctive central hole. *Galium* seeds are on average larger than *Asperula* and lacking the pronounced ridge in the middle of the central hole. Because of the number of species recorded in Anatolia, an identification to the species level is regarded as unrealistic.

Bibliography: Bojnanský and Fargašová 2007: 497-503

Plate 32 – d

Plant part: fruit

Preservation: charred

Ubiquity: KH-P I (9/25); KH-P II (24/41); KH-P III (27/56); KH-P IV (13/31); KH-P VA (6/10); KH-P VB (3/9); KH-P VI (2/2)

Count: KH-P I (25); KH-P II (87); KH-P III (102); KH-P IV (33); KH-P VA (17); KH-P VB (5); KH-P VI (3)

Plant part: fruit

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

- **Rubiaceae-Type 1**

Undetermined taxon attributed to the Rubiaceae family on the basis of the general anatomy.

Plate 32 – e

Plant part: fruit

Preservation: charred

Ubiquity: KH-P II (2/41)

Count: KH-P II (2126)

SCROPHULARIACEAE

- ***Scrophularia/Verbascum* sp.** – figworths/mullein

Annual, biennial, or perennial herbs, rarely small shrubs. 57 species of *Scrophularia* and 228 species of *Verbascum* are listed in the Flora of Turkey.

Identification notes: almost cylindrical seeds, with deeply reticulated surface, pits, and ridges. An identification to the genus or species level is not feasible due to the complexity of these genera, not fully accessible in the available reference materials.

Bibliography: Bojnanský and Fargašová 2007: 607-611

Plate 32 – f, g

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (3/25); KH-P II (3/41); KH-P III (8/56); KH-P IV (2/31); KH-P VB (1/10)

Count: KH-P I (5); KH-P II (4); KH-P III (10); KH-P IV (2); KH-P VB (1)

- ***Veronica dilleniid*-Type** – Dillen's speedwell type

In the Flora of Turkey *V. dillenii* is documented in C- and N-Anatolia, growing on open pine and oak woodland, rocky and sandy slopes.

Identification notes: shield shaped, compressed, seeds. The dorsal side is slightly convex. On the ventral side the distinctive oval chalaza and seam are visible; radially oriented shallow ridges are present. The specimens closely match *V. dillenii*, the identification is considered as type due to the large number of species present in the *Veronica* genus (79 described in the Flora of Turkey), not fully described or accessible in the available reference materials.

Bibliography: Bojnanský and Fargašová 2007: 619

Plate 32 – h

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (2/56)

Count: KH-P II (1); KH-P III (2)

- ***Veronica hederifolia*** – ivy-leaved speedwell

Speedwell species commonly growing in fields, roadside, waste places, woodlands and clearing.

Identification notes: shell-shaped, sub-globose, seed. The dorsal side is convex, on the ventral side it is present a large and deep hole. The surface is rugose.

Bibliography: Bojnanský and Fargašová 2007: 621

Plate 33 – a

Plant part: seed

Preservation: charred

Ubiquity: KH-P III (1/56)

Count: KH-P III (1)

- ***Veronica polita*-Type** – grey-field speedwell type

Annual herb. Widespread in Anatolia, growing on bare soil, open forests, steppe, cultivated land, and roadsides.

Identification notes: ovoid to oval seed. The dorsal side is convex with parallel ridges, the ventral side is concave. The specimens closely match *V. polita*, the identification is considered as type due to the large number of species present in the *Veronica* genus (79 described in the Flora of Turkey), not fully described or accessible in the available reference materials.

Bibliography: Bojnanský and Fargašová 2007: 621-623

Plate 33 – b

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (2/41); KH-P III (2/56)

Count: KH-P I (3); KH-P II (2); KH-P III (4)

- ***Veronica triphyllos*** – finger speedwell

Erect annual herb. *Veronica triphyllos* is widespread in Anatolia, growing in pine forests, stony pastures, rocky hills, banks, sandy fields, gardens, and roadsides.

Identification notes: obovate seed, the dorsal side convex, the ventral side concave, with a distinct chalaza and seam.

Bibliography: Bojnanský and Fargašová 2007: 623

Plate 33 – c

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P VB (1/9)

Count: KH-P VB (1)

SOLANACEAE

- ***Hyoscyamus* sp.** – henbane

Annual, biennial, or perennial herbs; 6 species of *Hyoscyamus* are described in the Flora of Turkey, which are commonly found on stony or rocky places, cereal fields, roadsides, and waste places

Identification notes: reniform to obovate seed, irregularly shaped. A distinctive reticulate-foveate surface pattern is present.

Bibliography: Bojnanský and Fargašová 2007: 595

Plate 33 – d, e, f

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (7/25); KH-P II (22/41); KH-P III (31/56); KH-P IV (21/31); KH-P VA (8/10); KH-P VB (8/9); KH-P VI (2/2)

Count: KH-P I (20); KH-P II (74); KH-P III (198); KH-P IV (61); KH-P VA (18); KH-P VB (22); KH-P VI (2)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P II (1/41); KH-P III (1/56); KH-P IV (1/31)

Count: KH-P II (1); KH-P III (1); KH-P IV (2)

- ***Solanum* sp.** – nightshade

Annual to perennial herbs or shrubs. 8 species of *Solanum* are described in the Flora of Turkey.

Identification notes: oval, flattened, seed. The surface is fine reticulate-foveate.

Bibliography: Bojnanský and Fargašová 2007: 597-599

Plate 33 – g

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (4)

THYMELAEACEAE

- ***Thymelaea* sp.** – sparrow-worts

Herbaceous annuals, suffrutescent perennials or low shrubs. 7 species are described in the Flora of Turkey. *T. passerina* is the most common species of the genus in central Anatolia, growing in fallow fields and stony pastures, eroded slopes, dry riverbeds, and salt-flats.

Identification notes: pyriform achenes, having an obtuse beaked apex and a rounded base. The surface is dull.

Bibliography: Bojnanský and Fargašová 2007: 413

Plate 33 – h

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (2/56); KH-P IV (3/31); KH-P VA (2/10); KH-P VB (2/9)

Count: KH-P II (1); KH-P III (2); KH-P IV (3); KH-P VA (2); KH-P VB (2)

ULMACEAE

- ***Celtis* sp.** – hackberries

Trees or more rarely shrubs. 4 species of *Celtis* are described in the Flora of Turkey. *C. turnefortii* and *C. glabrata* are distributed in C-Anatolia. The genus is currently reclassified in the Cannabaceae family.

Identification notes: globose stone, with a reticulate-rugose surface.

Bibliography: Bojnanský and Fargašová 2007: 41

Plate 34 – a

Plant part: endocarp

Preservation: uncharred

Ubiquity: KH-P VI (1/2)

Count: KH-P VI (3)

VALERIANACEAE

- ***Valerianella coronata*-Type** – crowned corn-salad type

Annual herb. *V. coronata* is widespread in Anatolia, growing on rocky slopes, open woodlands, fields, and roadsides.

Identification notes: obconical-ovoid achene. On the apex it is preserved part of the calyx. The base is rounded. On the ventral side it is present a long oval opening. The surface is finely reticulated.

Bibliography: Bojnanský and Fargašová 2007: 515

Plate 34 – b

Plant part: achene

Preservation: charred

Ubiquity: KH-P II (6/41); KH-P III (14/56); KH-P IV (6/31); KH-P VA (2/10)

Count: KH-P II (15); KH-P III (41); KH-P IV (10); KH-P VA (3)

- ***Valerianella vesicaria*-Type** – Bladder Corn Salad type

Annual herb, growing on rocky slopes and fields.

Identification notes: ovate achene, with a pointed apex and a relatively rounded base. A rounded opening is present on the ventral side. The surface is finely reticulated.

Bibliography: van Zeist and Bakker-Heeres 1985: 263

Plate 34 – c

Plant part: achene

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

VITACEAE

- ***Vitis vinifera*** – grape

Well known vine of economic importance.

Identification notes: different morphotypes are attested, as discussed in Section 6.4.4. Entire grape seeds are measured, data are reported in Appendix 8. In addition to pips, also pedicels and entire berries are found.

Bibliography: Renfrew 1973: 125-131

Plate 34 – d, e, f, g, h

Plate 35 – a, b, c

Plant part: seed

Preservation: charred

Ubiquity: KH-P I (13/25); KH-P II (26/41); KH-P III (39/56); KH-P IV (19/31); KH-P VA (7/10)

Count: KH-P I (18); KH-P II (286); KH-P III (251); KH-P IV (58); KH-P VA (10)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P II (1/25); KH-P III (2/41); KH-P III (3/56); KH-P IV (1/31)

Count: KH-P II (2); KH-P III (3); KH-P III (3); KH-P IV (1)

Plant part: pedicel

Preservation: charred

Ubiquity: KH-P I (3/25); KH-P II (14/41); KH-P III (16/56); KH-P IV (10/31); KH-P VA (3/10)

Count: KH-P I (3); KH-P II (140); KH-P III (114); KH-P IV (25); KH-P VA (4)

Plant part: skin fragment

Preservation: charred

Ubiquity: KH-P IV (1/31)

Count: KH-P IV (1)

Plant part: whole berry

Preservation: charred

Ubiquity: KH-P II (2/41)

Count: KH-P II (4)

Plant part: tendril

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (1/56)

Count: KH-P II (5); KH-P III (2)

ZYGOPHYLLACEAE

- ***Peganum harmala*** – Syrian rue

Peganum is a monospecific genus in the Flora of Turkey. Syrian rue is an erected, perennial, herb. It grows in waste places and steppe. Syrian rue has a traditional pharmaceutical use.

Identification notes: irregular seeds, with a somewhat triangular outline – broad base, tapering toward the apex. The surface is reticulate. Uncharred specimens are likely to be considered modern contaminant; *P. harmala* is abundantly present in the local modern vegetation growing on site.

Bibliography: van Zeist and Bakker-Heeres 1985: 264

Plate 35 – d

Plant part: seed

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (1)

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P I (3/25)

Count: KH-P II (598)

- ***Tribulus terrestris*** – goat's-head

T. terrestris is the only species of the genus described in the Flora of Turkey. It grows in open or sandy places, and fallow fields.

Identification notes: woody fruit, with rigid long spines: two longer ones on each side, and several smaller. It is very likely a contaminant.

Bibliography: Bojnanský and Fargašová 2007: 393

Plate 35 – e

Plant part: seed

Preservation: uncharred

Ubiquity: KH-P III (1/56); KH-P IV (2/31); KH-P VB (1/9); KH-P VI (1/2)

Count: KH-P III (1); KH-P IV (3); KH-P VB (1); KH-P VI (1)

UNKNOWN SEED/FRUIT

- **KH-unk1**

Plate 35 – f, g, h

Preservation: charred

Ubiquity: KH-P I (5/25); KH-P II (12/41); KH-P III (30/56)

Count: KH-P I (412); KH-P II (1916); KH-P III (9548)

- **KH-unk2**

Plate 36 – a

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (5/56); KH-P IV (2/31); KH-P VA (4/10); KH-P VB (4/9)

Count: KH-P II (6); KH-P III (10); KH-P IV (2); KH-P VA (5); KH-P VB (22)

- **KH-unk3**

Plate 36 – b

Preservation: charred

Ubiquity: KH-P II (2/41); KH-P III (5/59); KH-P IV (5/31); KH-P VA (3/10); KH-P VI (1/2)

Count: KH-P II (9); KH-P III (7); KH-P IV (7); KH-P VA (3); KH-P VI (1)

- **KH-unk4**

Plate 36 – c

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (4/41); KH-P III (1/56); KH-P IV (2/31)

Count: KH-P I (7); KH-P II (5); KH-P III (1); KH-P IV (2)

- **KH-unk5**

Plate 36 – d

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (1/41); KH-P III (6/59)

Count: KH-P I (1); KH-P I (1); KH-P III (6)

- **KH-unk6**

Plate 36 – e

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (3/41); KH-P IV (1/31)

Count: KH-P I (1); KH-P II (11); KH-P IV (1)

- **KH-unk7**

Plate 36 – f

Preservation: charred

Ubiquity: KH-P III (3/56)

Count: KH-P III (4)

- **KH-unk8**

Plate 36 – g

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P VB (2/9)

Count: KH-P II (1); KH-P VB (2)

- **KH-unk9**

Plate 36 – h

Preservation: charred

Ubiquity: KH-P VB (3/9)

Count: KH-P VB (3)

- **KH-unk10**

Plate 37 – a

Preservation: charred

Ubiquity: KH-P II (2/41)

Count: KH-P II (3)

- **KH-unk11**

Plate 37 – b

Preservation: charred

Ubiquity: KH-P III (2/56)

Count: KH-P III (4)

MISCELLANIA PLANT PARTS

- **Monocotyledons culm**

Plate 37 – c

Preservation: charred

Ubiquity: KH-P I (14/25); KH-P II (23/41); KH-P III (31/59); KH-P IV (15/31); KH-P VA (8/10); KH-P VB (6/9); KH-P VI (2/2)

Count: KH-P I (0.515g); KH-P II (1.981g); KH-P III (1.808g); KH-P IV (0.194); KH-P VA (0.296); KH-P VB (0.658); KH-P VI (0.002)

- **Roots**

Plate 37 – d, e

Preservation: charred

Ubiquity: KH-P II (1/41); KH-P III (1/56); KH-P IV (1/31)

Count: KH-P II (0.007); KH-P III (1.268); KH-P IV (0.001)

- **Bud**

Plate 37 – f

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (4/41); KH-P III (14/56); KH-P IV (6/31)

Count: KH-P I (1); KH-P II (8); KH-P III (34); KH-P IV (8)

- **Sclerotia**

Plate 37 – g

Preservation: uncharred

Ubiquity: KH-P II (4/41); KH-P III (9/56); KH-P IV (8/31); KH-P VA (5/10); KH-P VB (3/9)

Count: KH-P II (114); KH-P III (126); KH-P IV (25); KH-P VA (5); KH-P V B (15)

- **Sheep-Goat dung**

Plate 37 – h

Preservation: charred

Ubiquity: KH-P I (4/25); KH-P II (2/41)

Count: KH-P I (0.453g); KH-P II (0.094)

Preservation: charred

Ubiquity: KH-P II (1/41)

Count: KH-P II (0.028)

- **Seeds Clots**

Plate 38 – a, b

Preservation: charred

Ubiquity: KH-P III (5/56); KH-P IV (1/31)

Count: KH-P III (2.625); KH-P IV (1.635)

- **Vegetal plaster**

Plate 38 – c, d, e

Preservation: mineralized

INSECT REMAINS

- **Unknown larvae** – larva

Charred larva, identification was not aimed.

Plate 38 – f

Preservation: charred

Ubiquity: KH-P I (2/25); KH-P II (2/41); KH-P III (3/56); KH-P IV (1/31)

Count: KH-P II (2); KH-P II (3); KH-P III (7); KH-P IV (1)

- ***Sitophilus granarius*** – wheat weevil

Sitiohilous granarious is a well-known wingless pest of stored cereals, archaeological documented since the Neolithic. Plarre 2010 provides a review of this species in relation to human activities.

Plate 38 – g

Preservation: charred

Ubiquity: KH-P I (1/25); KH-P II (1/41)

Count: KH-P I (1); KH-P II (1)

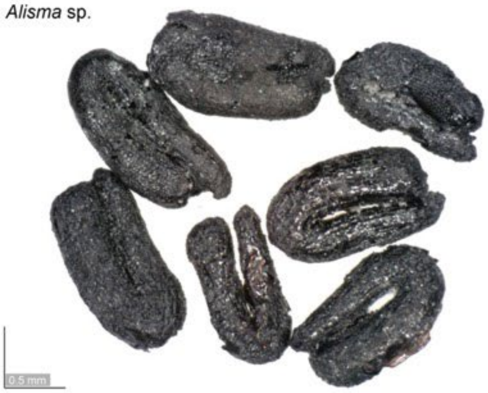
- **Coleoptera** – unknown beetle

Charred beetle. Pending specialistic study, an identification is not aimed.

Plate 38

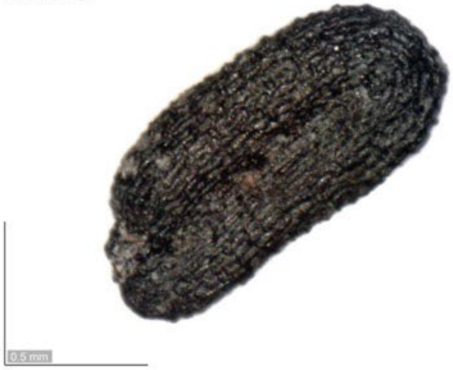
PLATE 7

Alisma sp.



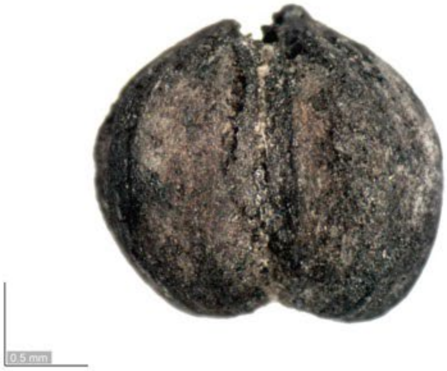
a

Alisma sp.



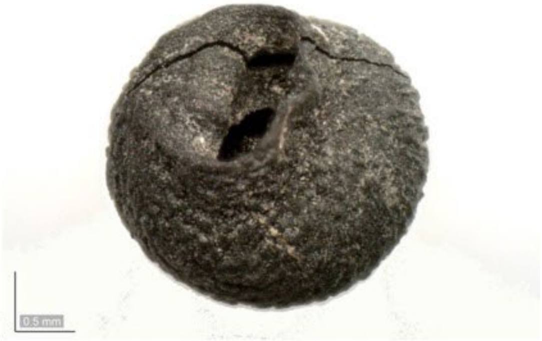
b

Apium Type



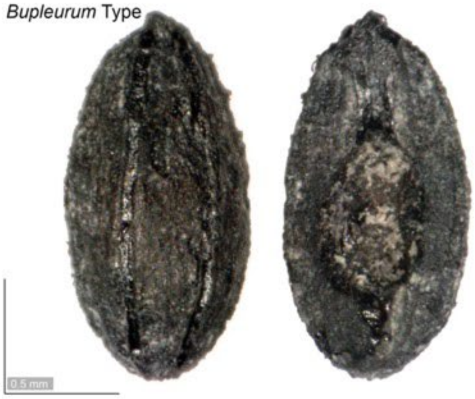
c

Bifora radians



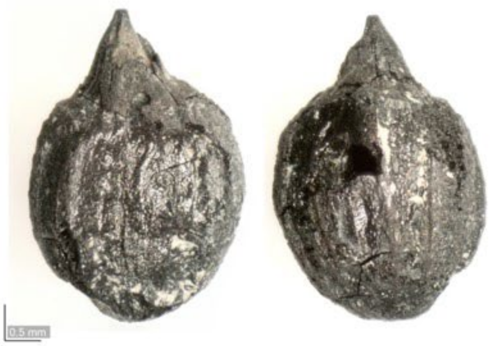
d

Bupleurum Type



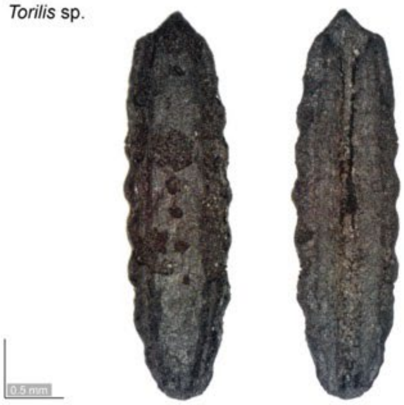
e

Coriandrum sativum



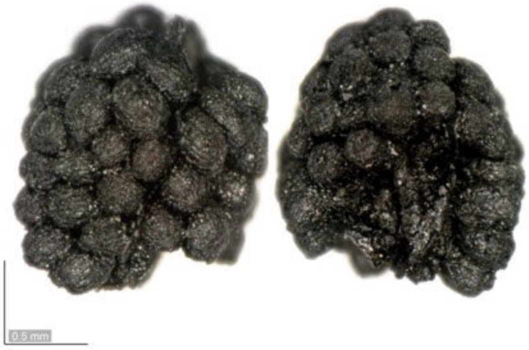
f

Torilis sp.



g

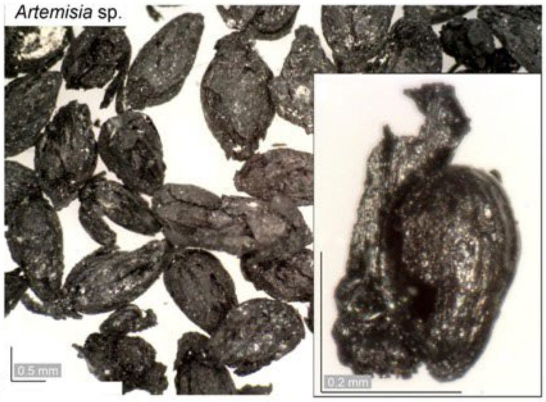
Artemisia sp.



h

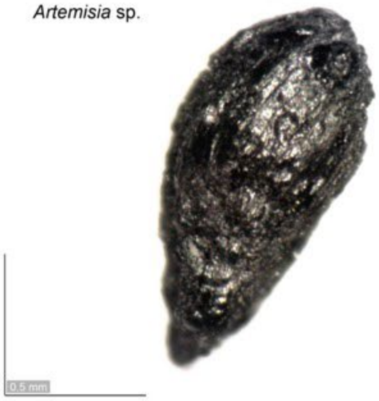
PLATE 8

Artemisia sp.



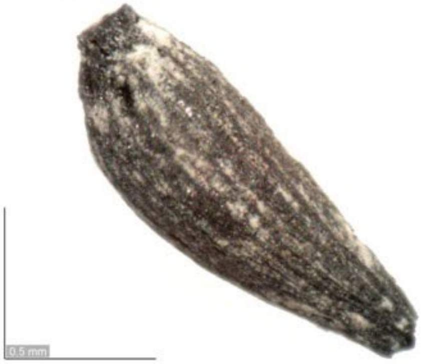
a

Artemisia sp.



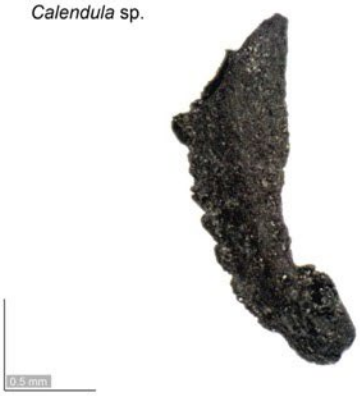
b

Aster sp.



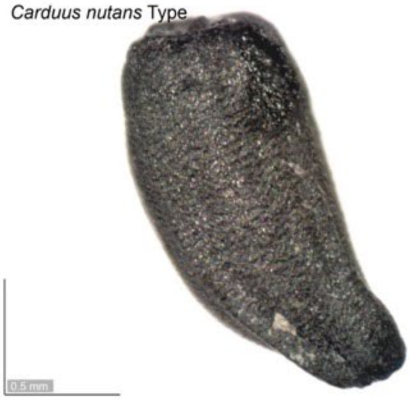
c

Calendula sp.



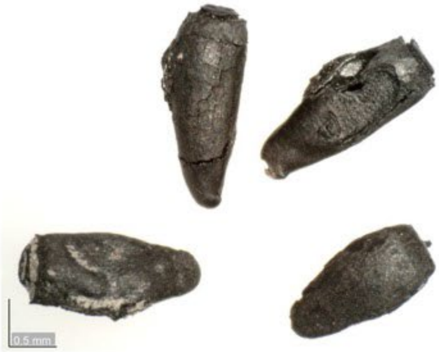
d

Carduus nutans Type



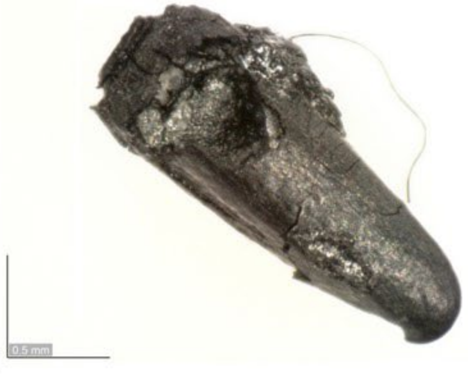
e

Centaurea sp.



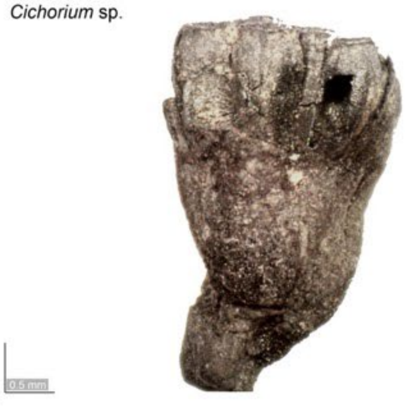
f

Centaurea sp.



g

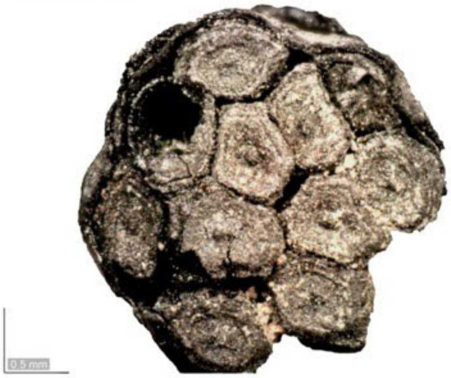
Cichorium sp.



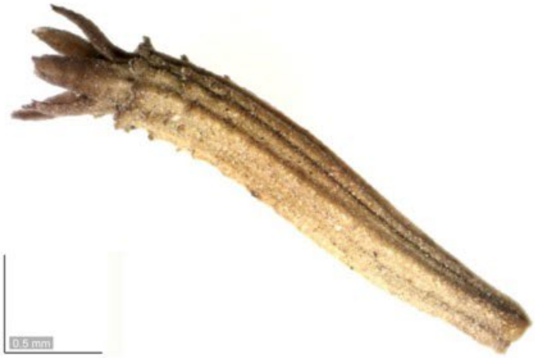
h

PLATE 9

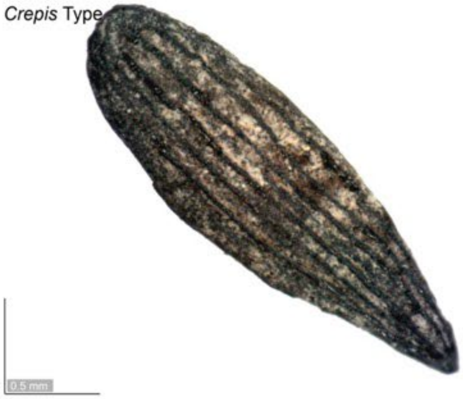
Cichorium sp.



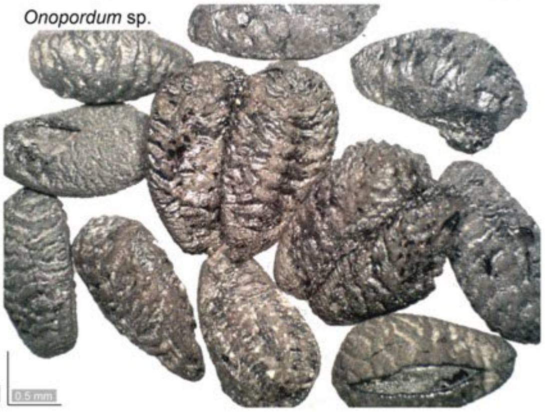
Chondrilla juncea



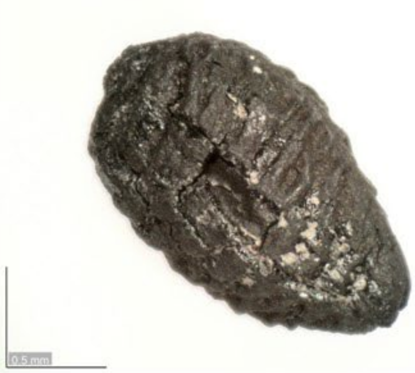
Crepis Type



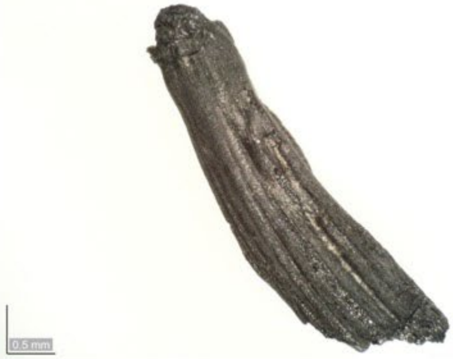
Onopordum sp.



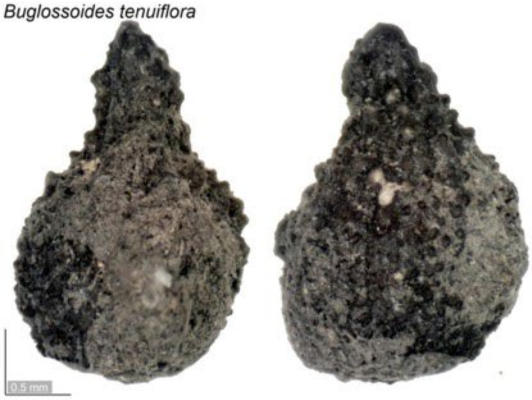
Onopordum sp.



Scorzonera sp.



Buglossoides tenuiflora



Buglossoides arvensis /
Arnebia decumbens

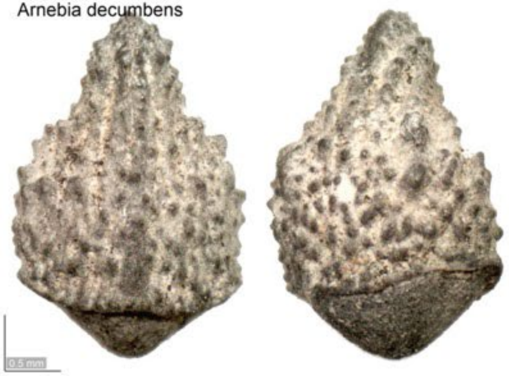
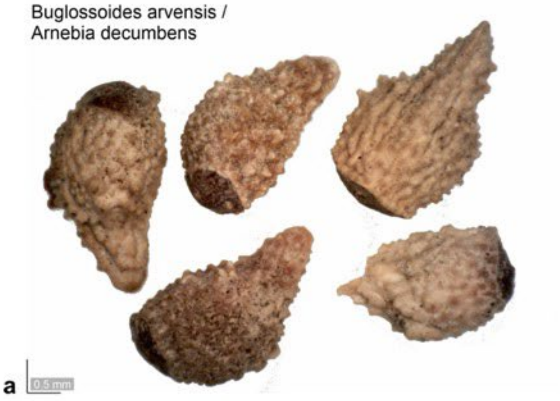
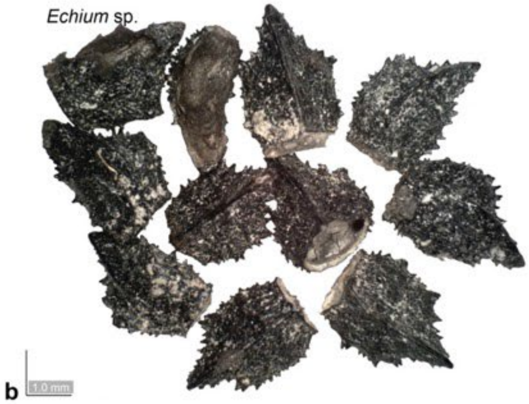


PLATE 10

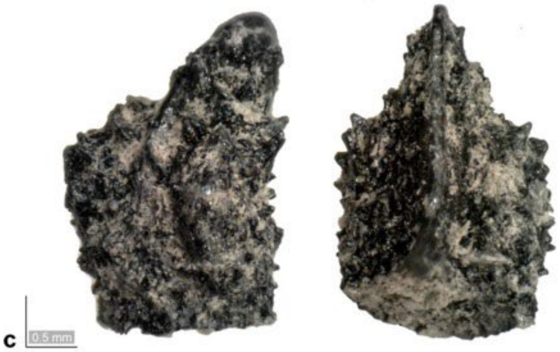
Buglossoides arvensis /
Arnebia decumbens



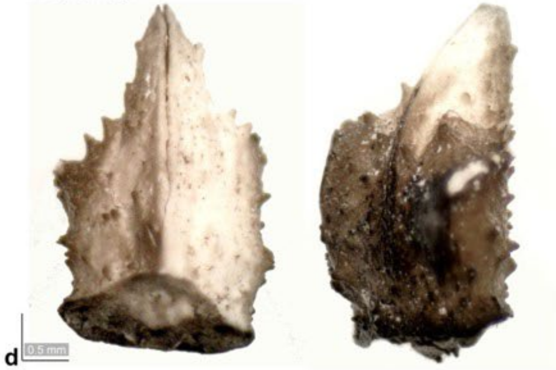
Echium sp.



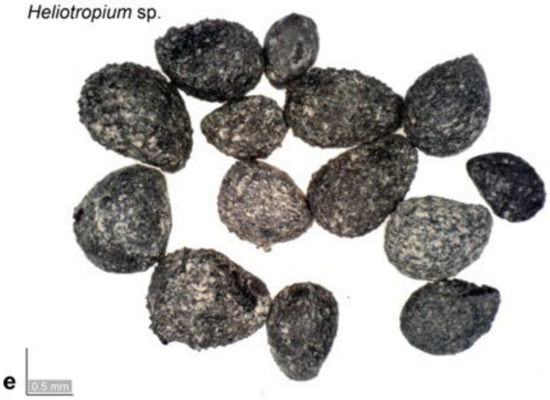
Echium sp.



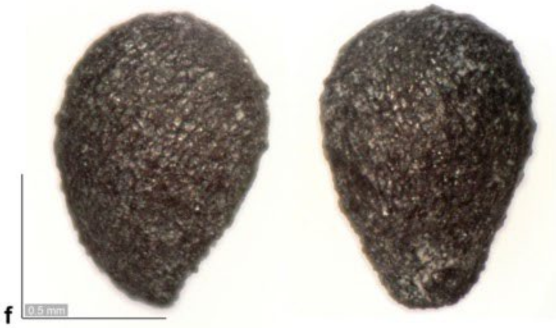
Echium sp.



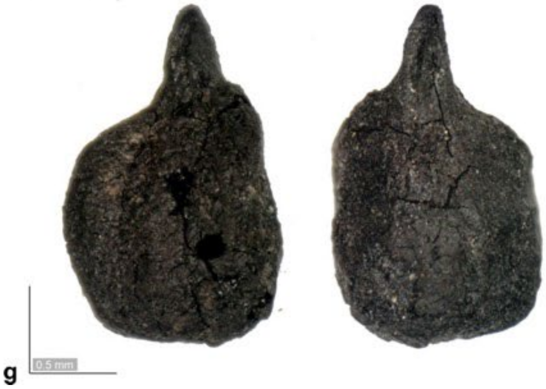
Heliotropium sp.



Heliotropium sp.



Onosma sp.



Onosma sp.

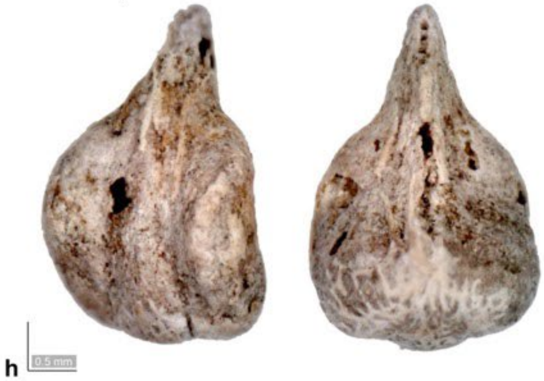
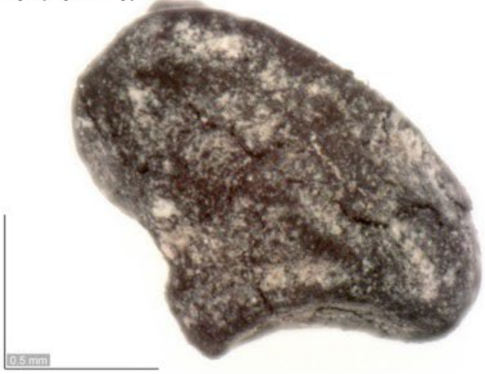


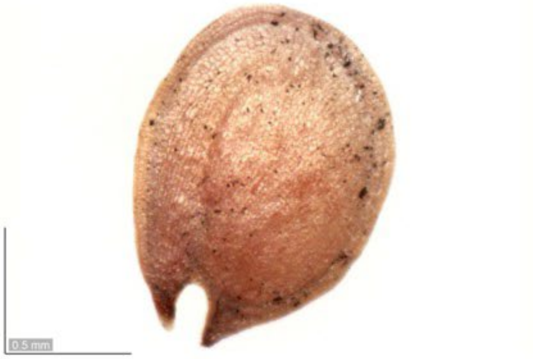
PLATE 11

Symphytum Type



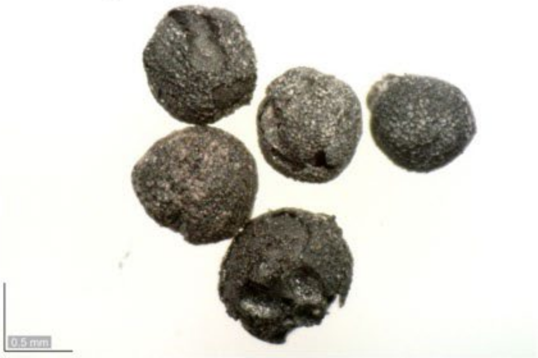
a

Alyssum sp.



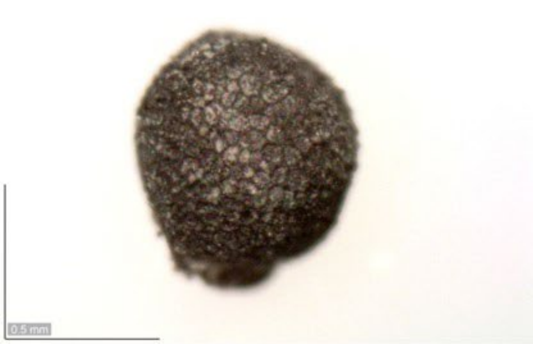
b

Brassica Type



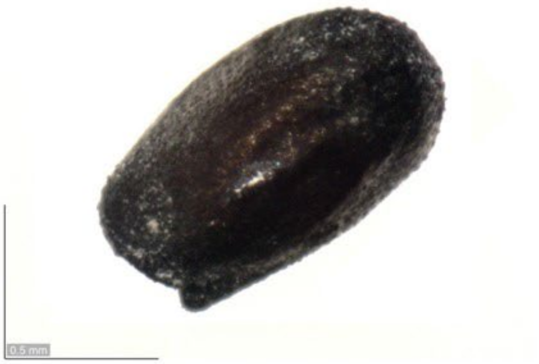
c

Brassica Type.



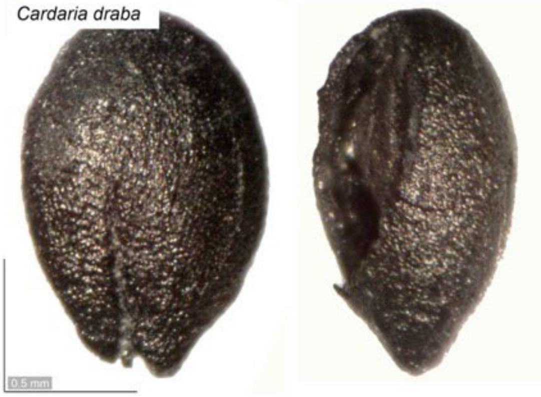
d

Camelina Type



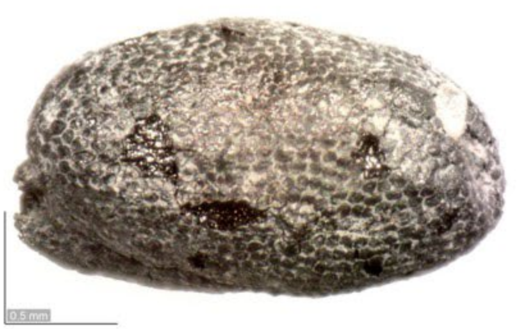
e

Cardaria draba



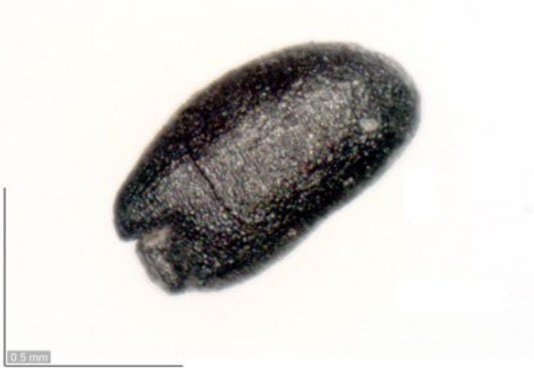
f

Conringia Type



g

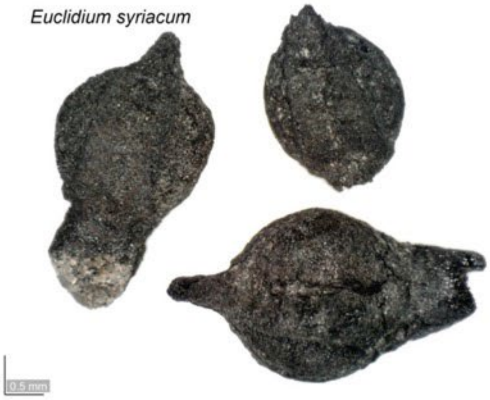
Descurania Type.



h

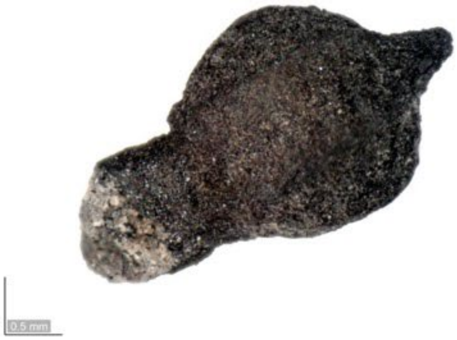
PLATE 12

Euclidium syriacum



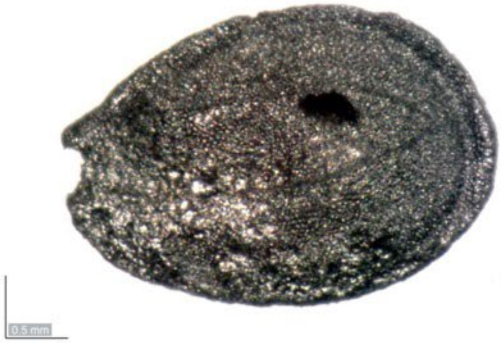
a

Euclidium syriacum



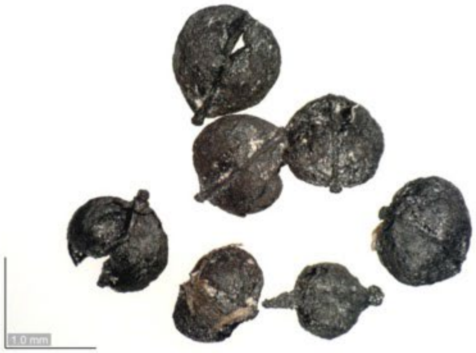
b

Lepidium perfoliatum



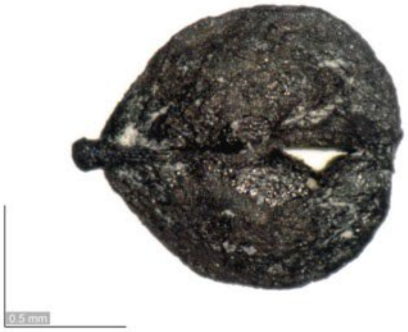
c

Lepidium sp.



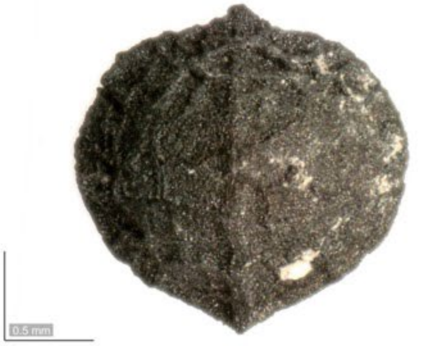
d

Lepidium sp.



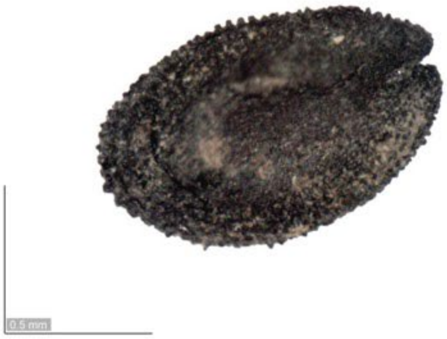
e

Neslia paniculata - silique



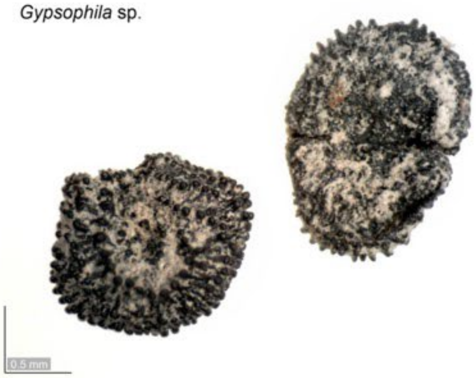
f

Bufonia sp.



g

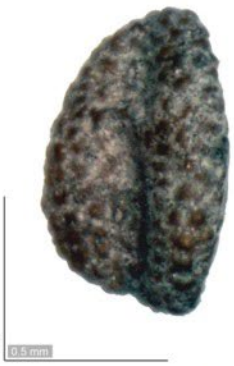
Gypsophila sp.



h

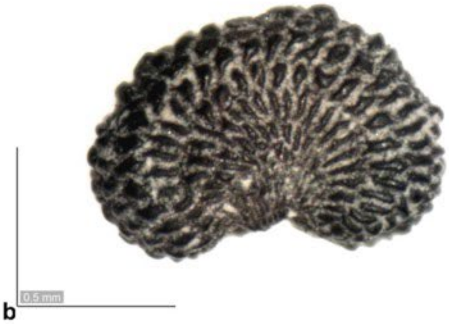
PLATE 13

Holosteum umbellatum



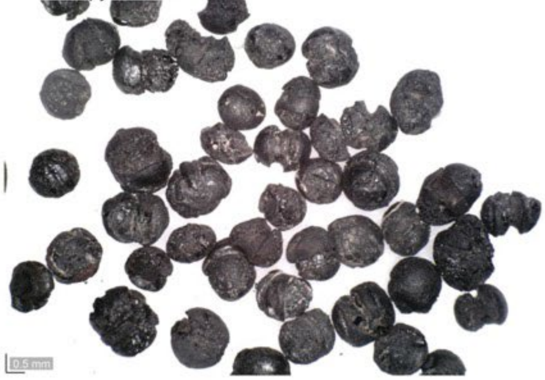
a

Silene sp.



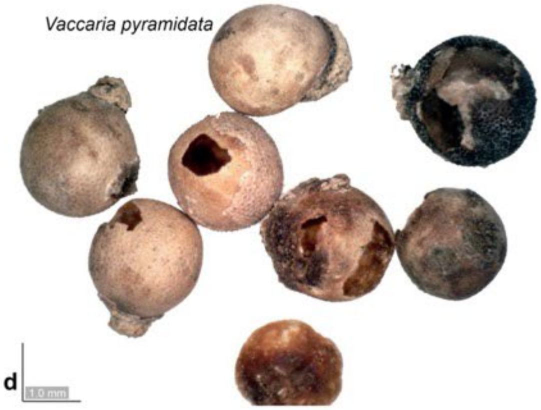
b

Vaccaria pyramidata



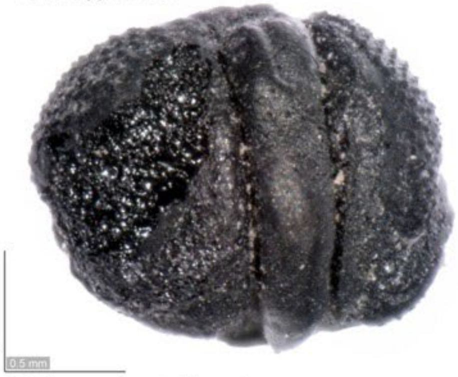
c

Vaccaria pyramidata



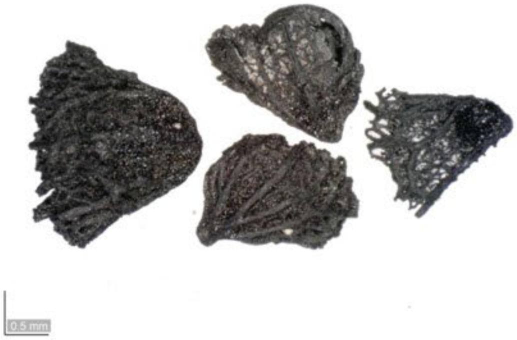
d

Vaccaria pyramidata



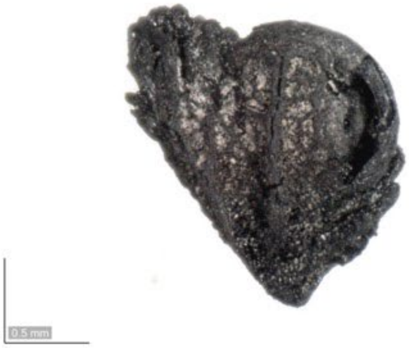
e

Atriplex sp. – bracts with seeds



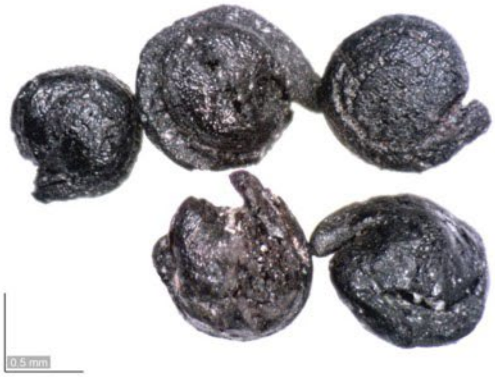
f

Atriplex sp. – bract with seed



g

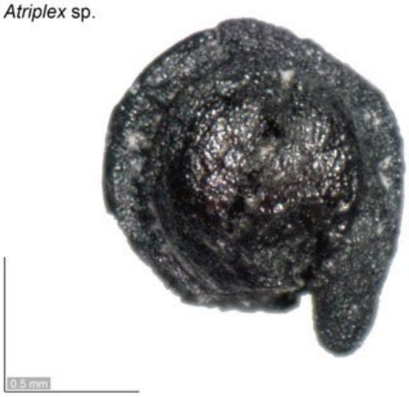
Atriplex sp.



h

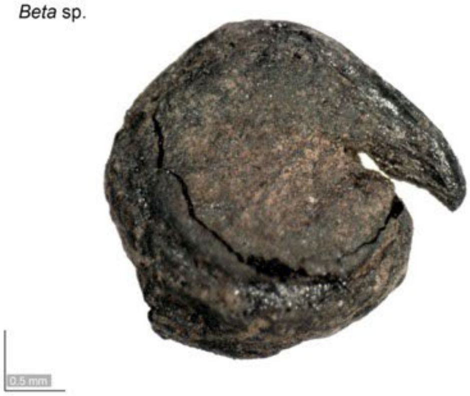
PLATE 14

Atriplex sp.



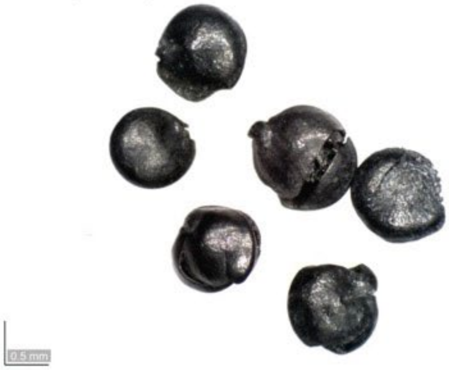
a

Beta sp.



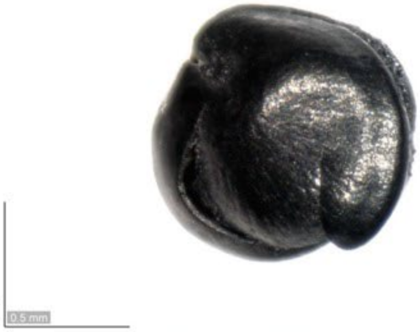
b

Chenopodium sp.



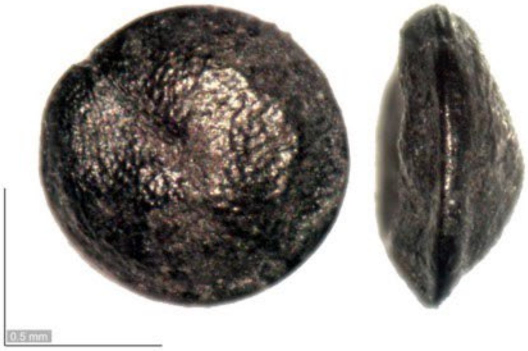
c

Chenopodium sp.



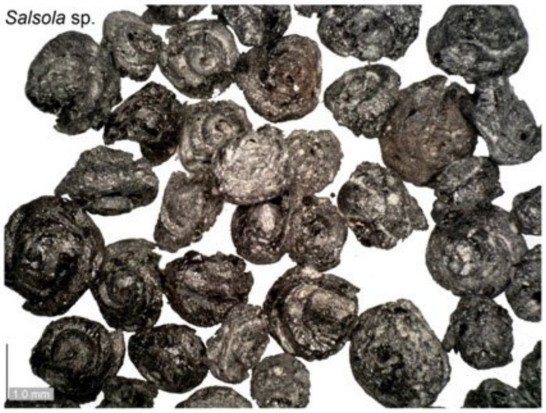
d

Chenopodium murale Type



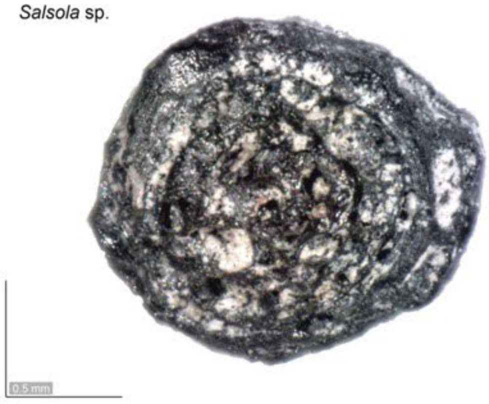
e

Salsola sp.



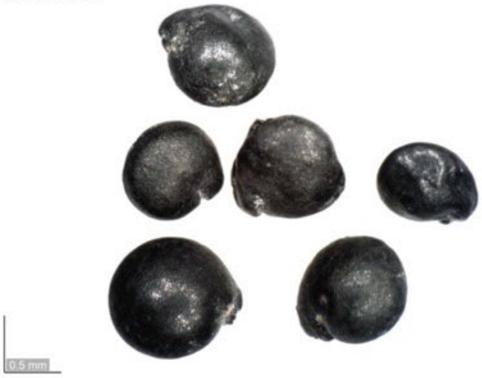
f

Salsola sp.



g

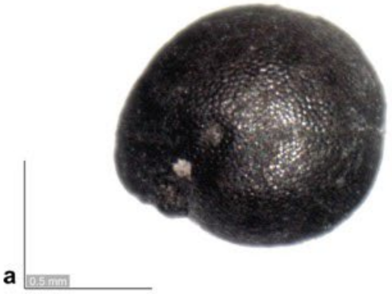
Suaeda sp.



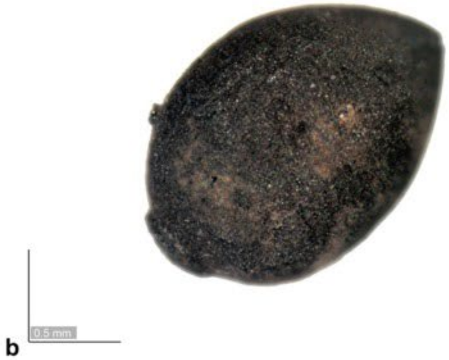
h

PLATE 15

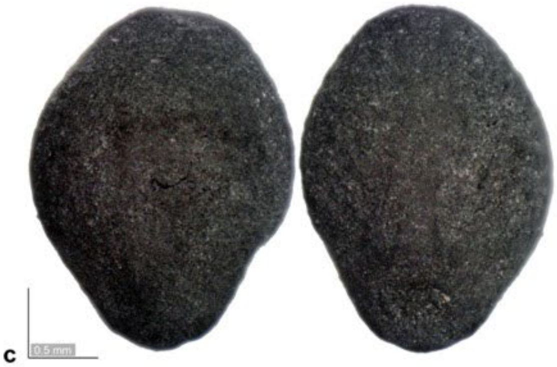
Suaeda sp.



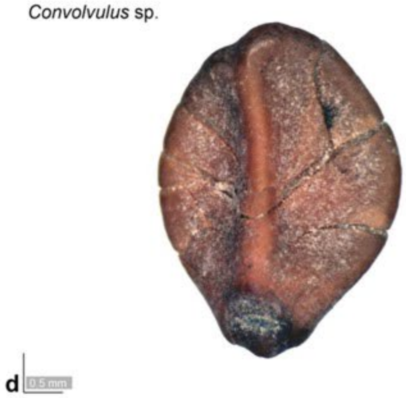
Helianthemum sp.



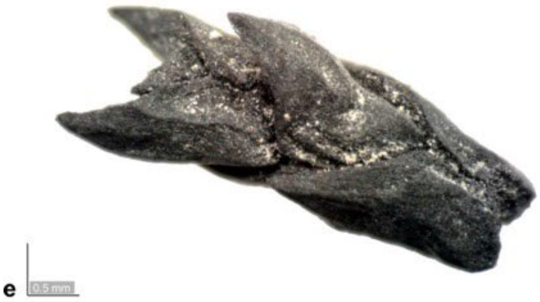
Convolvulus sp.



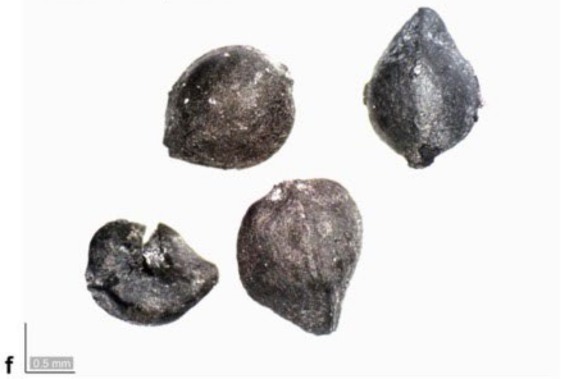
Convolvulus sp.



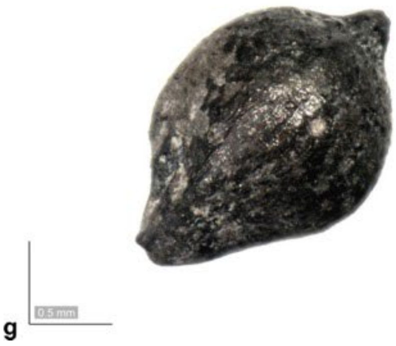
Juniperus excelsa Type - leaf fragment



Bolboschoenus glaucus



Bolboschoenus glaucus



Carex – fattened type

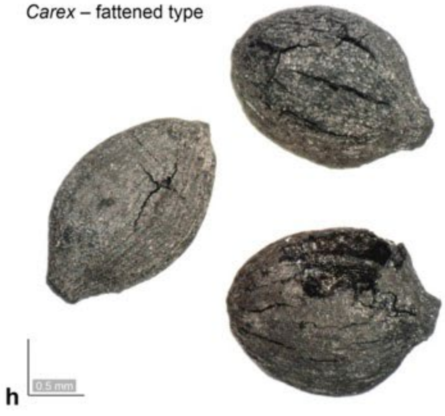
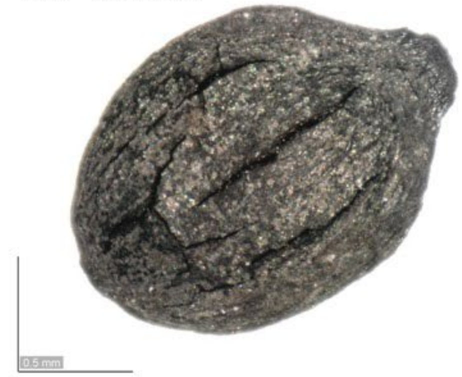


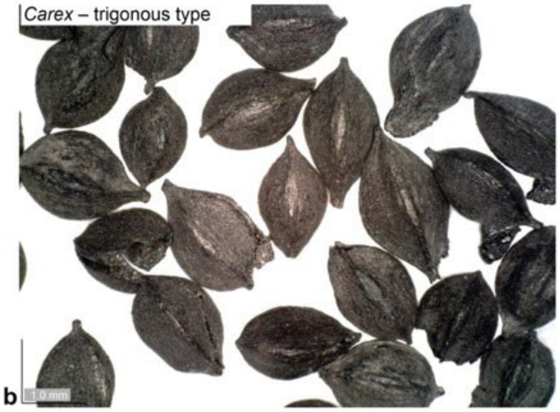
PLATE 16

Carex – fattened type



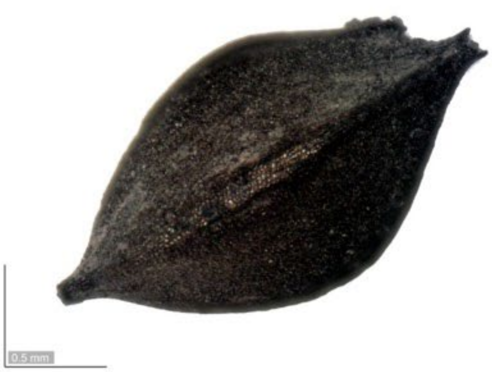
a

Carex – trigonous type



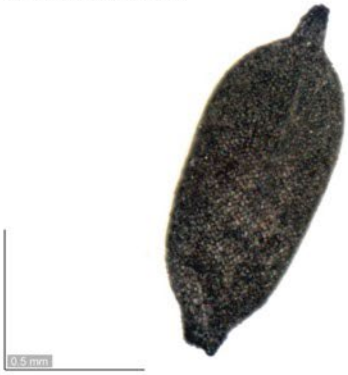
b

Carex – trigonous type



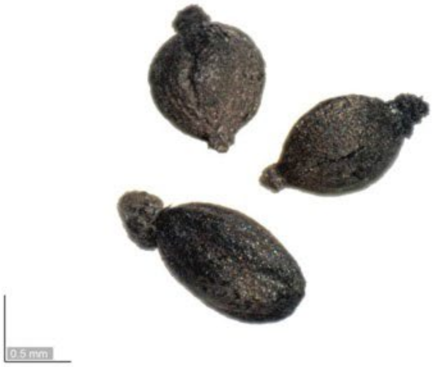
c

Cyperus longus Type



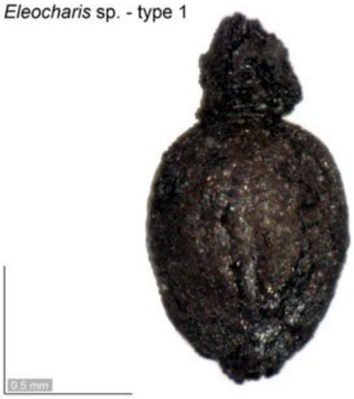
d

Eleocharis sp. - type1



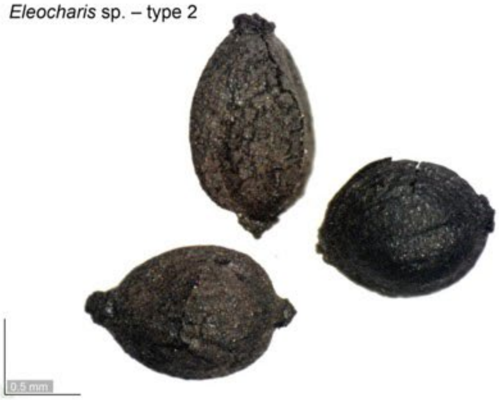
e

Eleocharis sp. - type 1



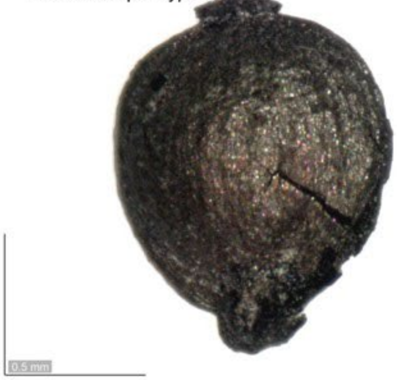
f

Eleocharis sp. – type 2



g

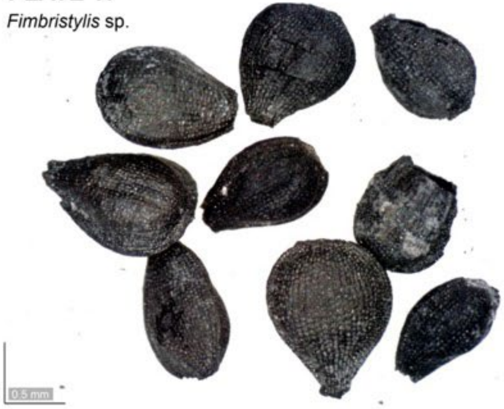
Eleocharis sp. – type 2



h

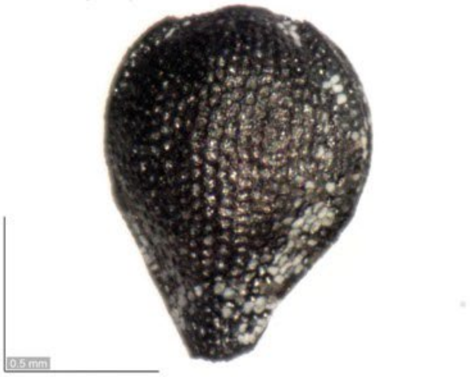
PLATE 17

Fimbristylis sp.



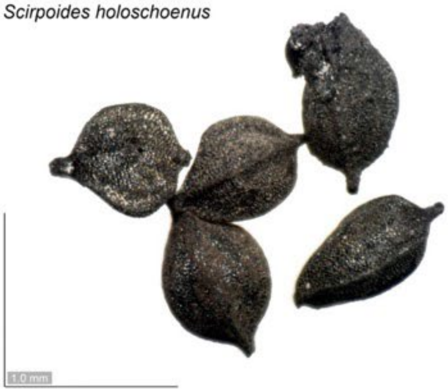
a

Fimbristylis sp.



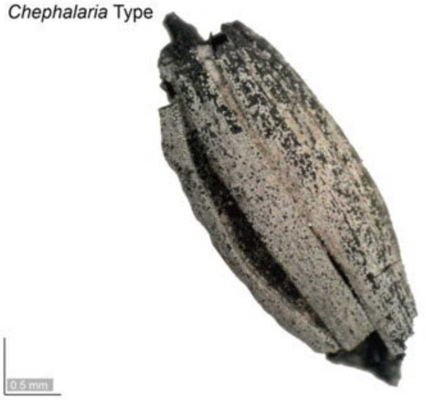
b

Scirpoides holoschoenus



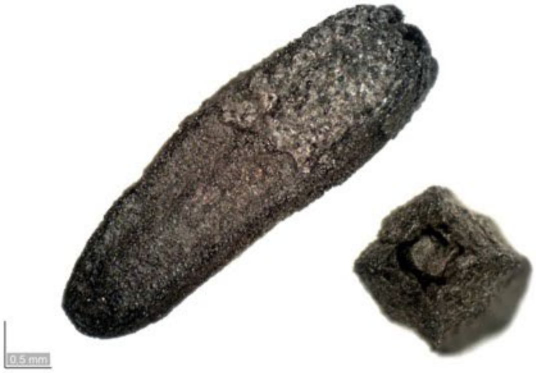
c

Chephalaria Type



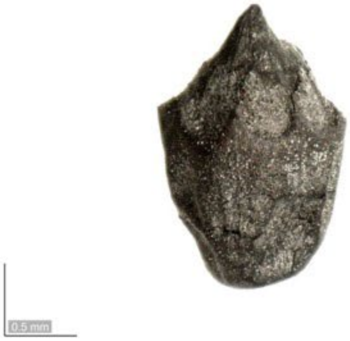
d

Dipsacus Type



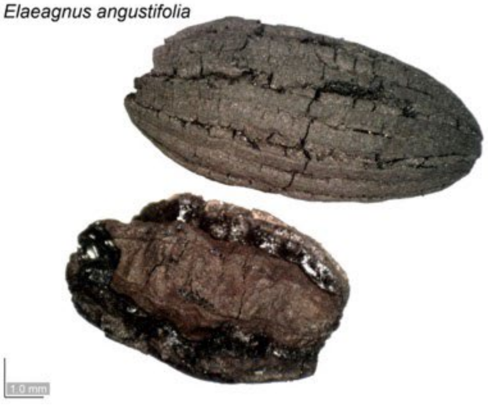
e

Scabiosa sp.



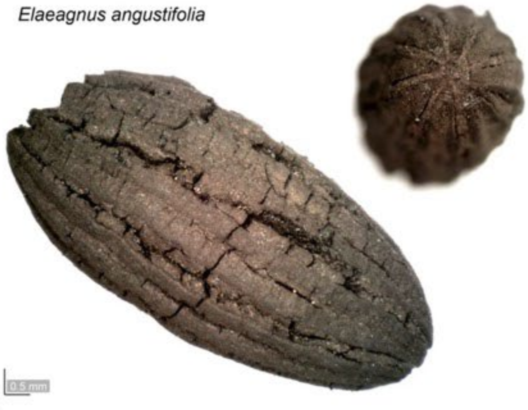
f

Elaeagnus angustifolia



g

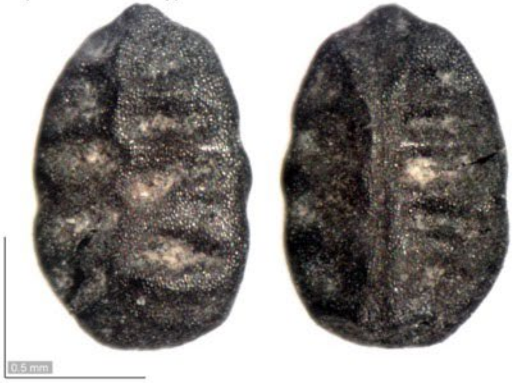
Elaeagnus angustifolia



h

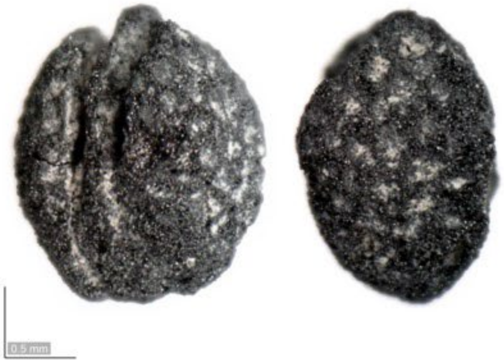
PLATE 18

Euphorbia falcata Type



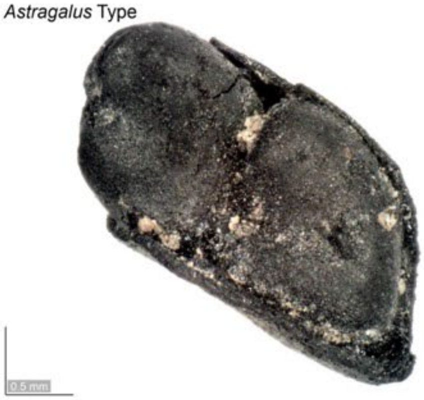
a

Euphorbia taurinensis Type



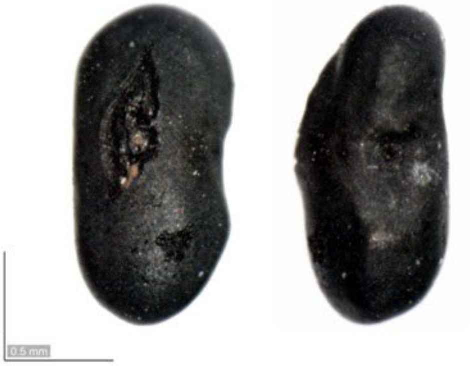
b

Astragalus Type



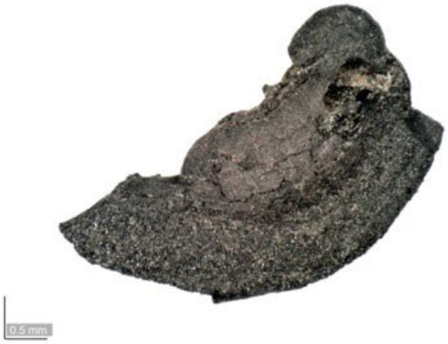
c

Coronilla Type



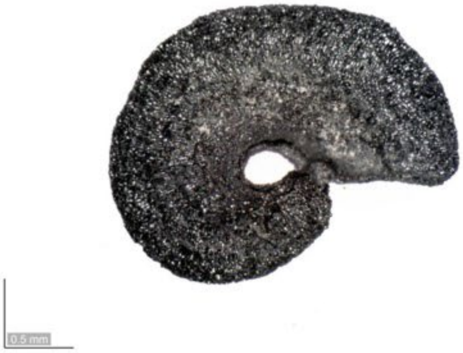
d

Medicago sp.



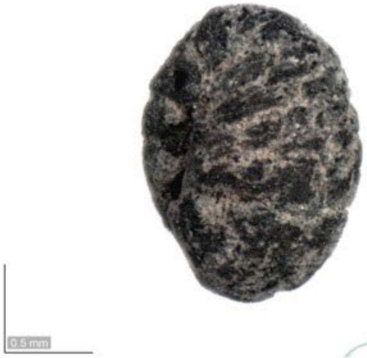
e

Medicago sp. – pod



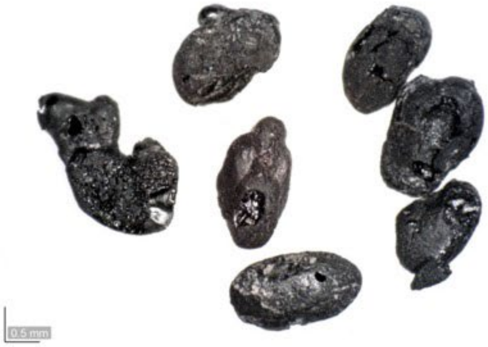
f

Medicago radiata



g

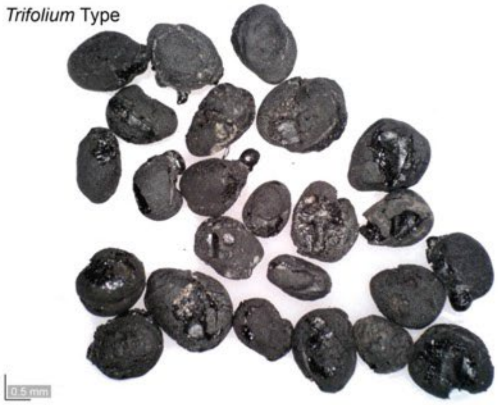
Melilotus Type



h

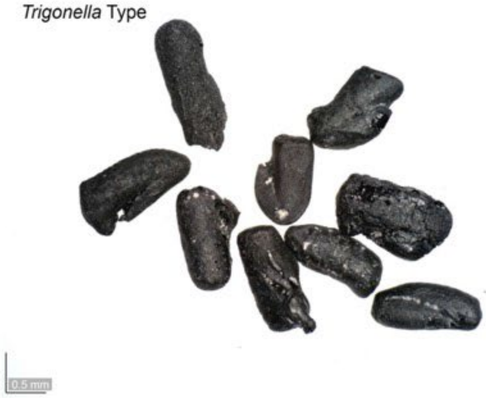
PLATE 19

Trifolium Type



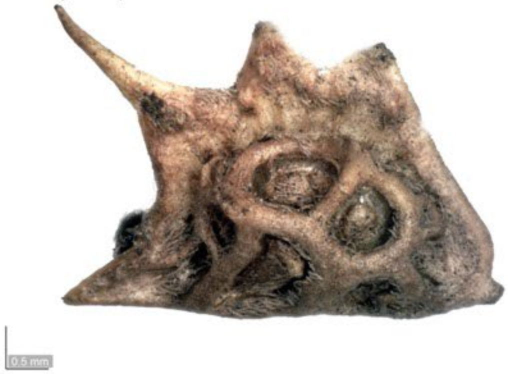
a

Trigonella Type



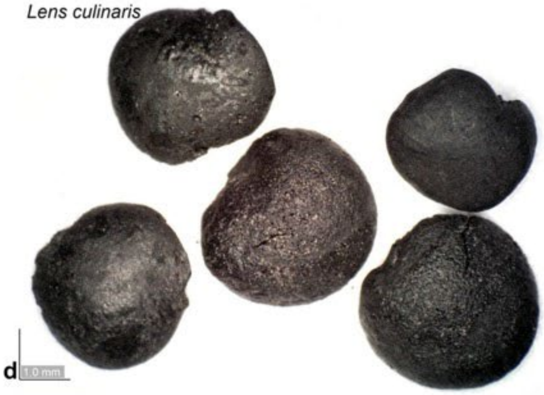
b

Onobrychis sp.



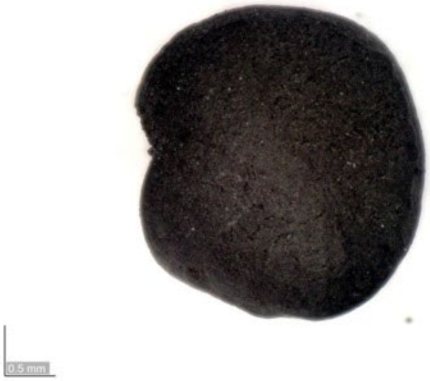
c

Lens culinaris



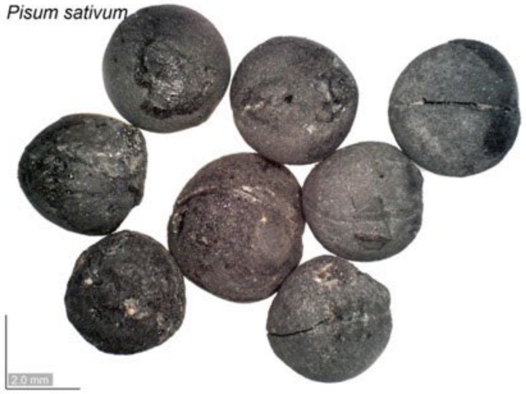
d

Lens culinaris



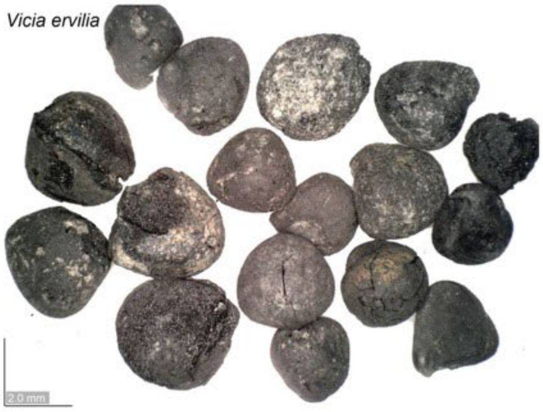
e

Pisum sativum



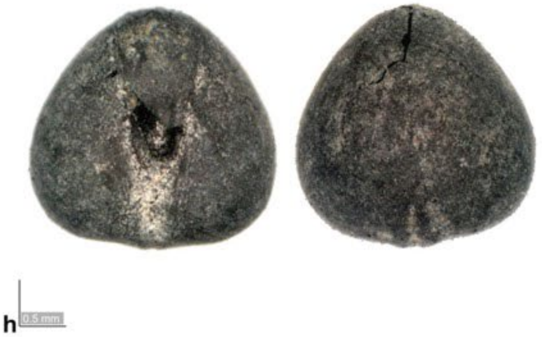
f

Vicia ervilia



g

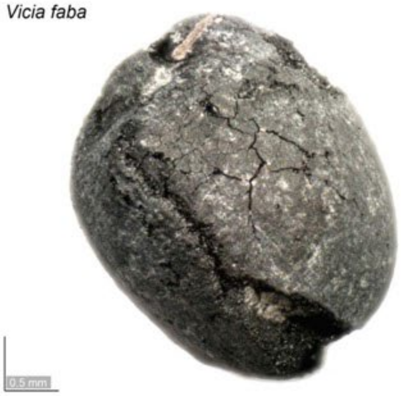
Vicia ervilia



h

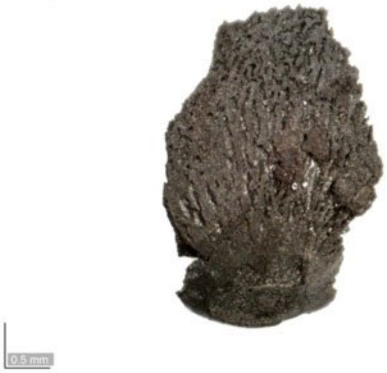
PLATE 20

Vicia faba



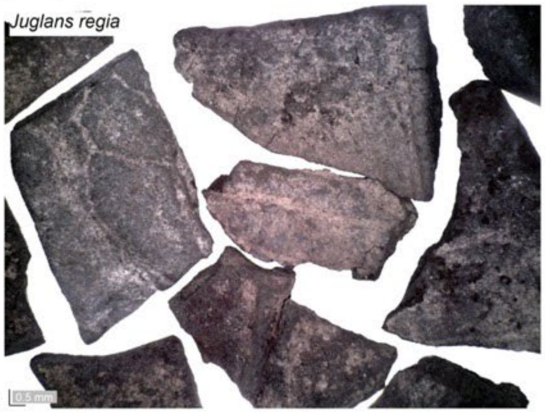
a

cf Quercus



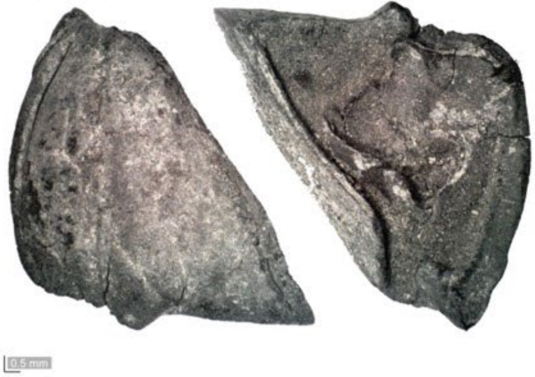
b

Juglans regia



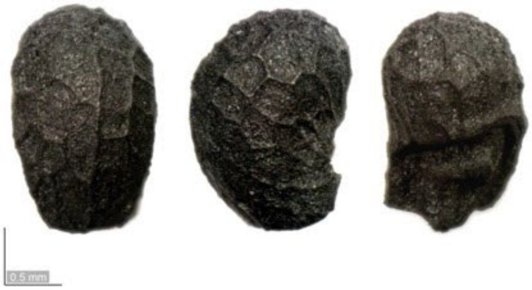
c

Juglans regia



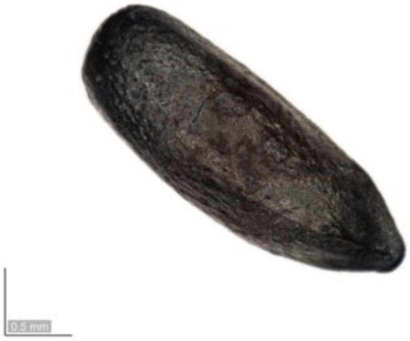
d

Ajuga Type



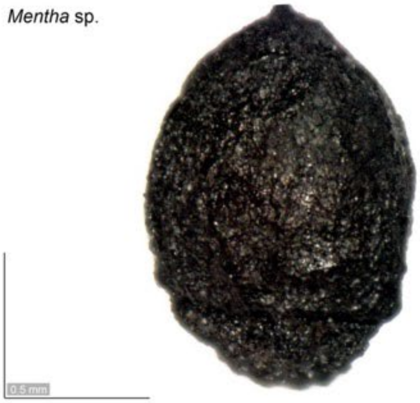
e

Lallemianta Type



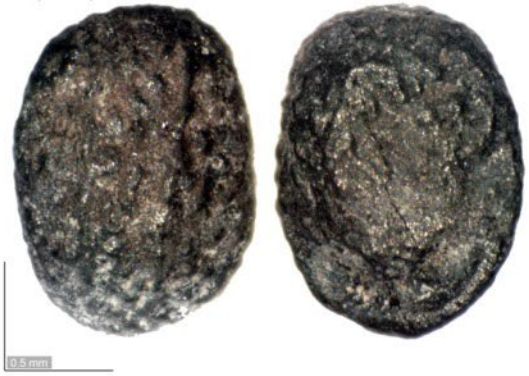
f

Mentha sp.



g

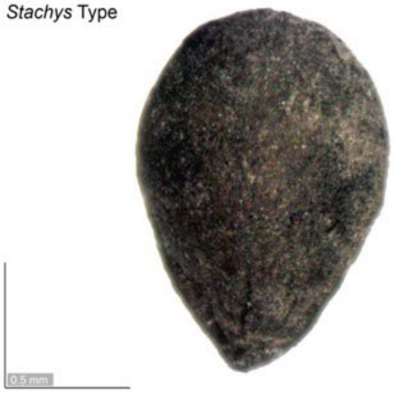
Nepeta sp.



h

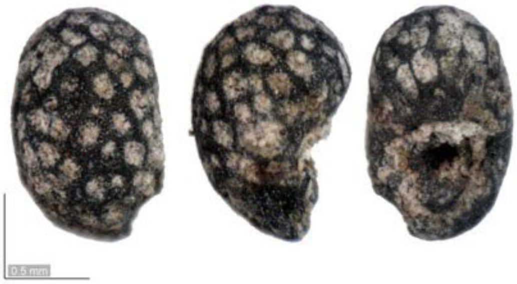
PLATE 21

Stachys Type



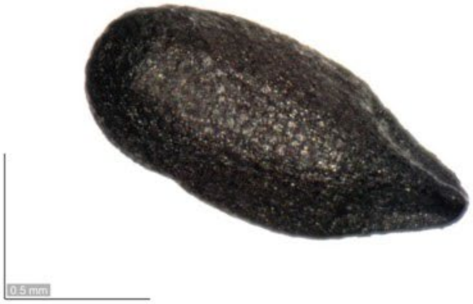
a

Teucrium Type



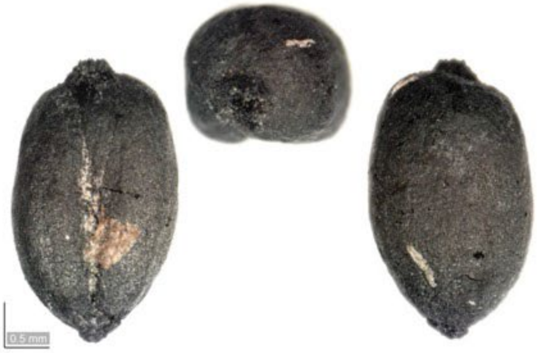
b

Ziziphora sp.



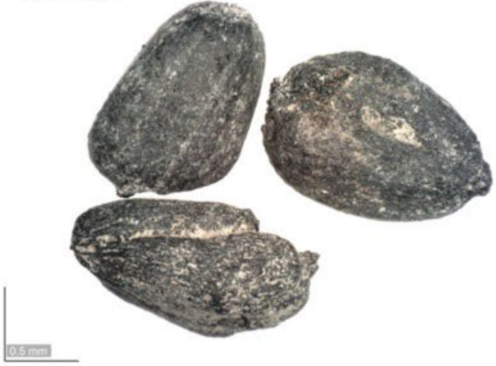
c

Allium Type



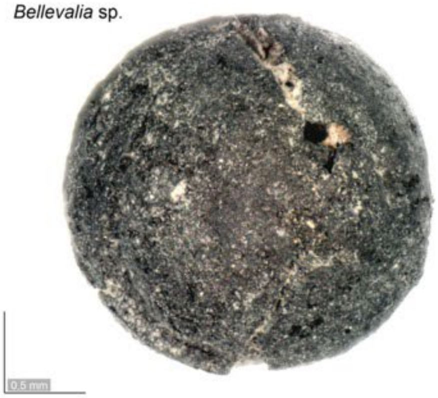
d

Allium Type



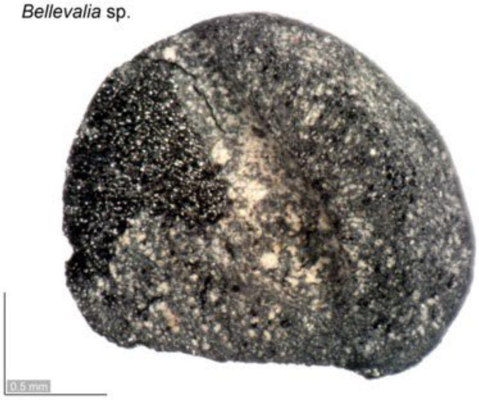
e

Bellevalia sp.



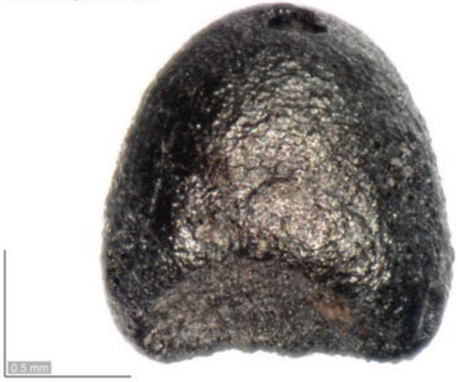
f

Bellevalia sp.



g

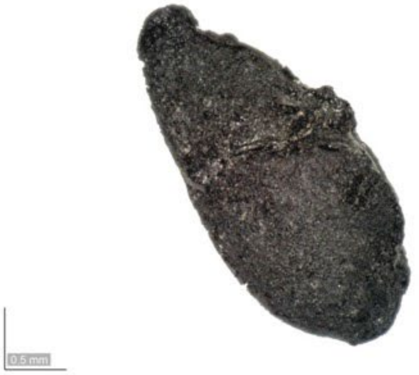
Ornithogalum sp.



h

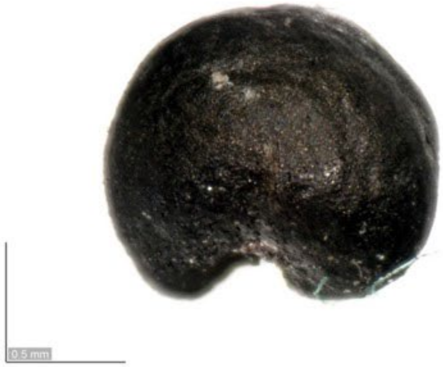
PLATE 22

Linum sp.



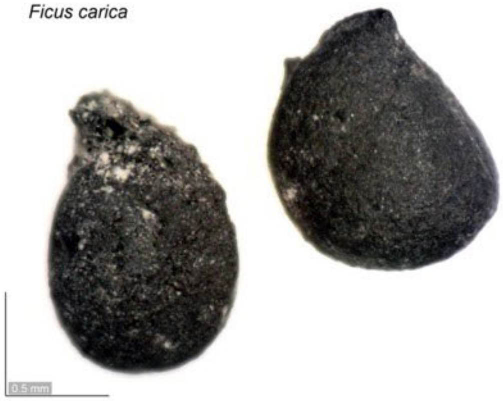
a

Malva sp.



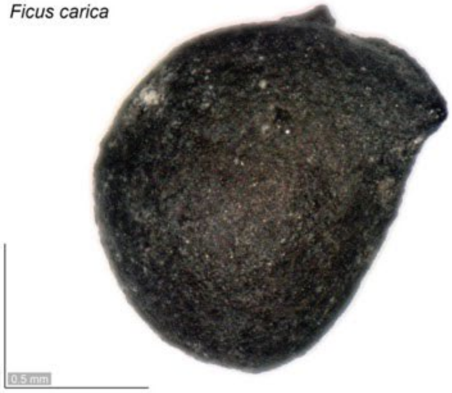
b

Ficus carica



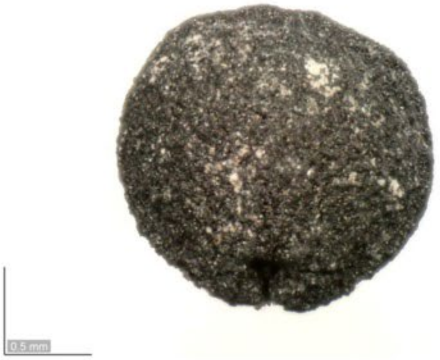
c

Ficus carica



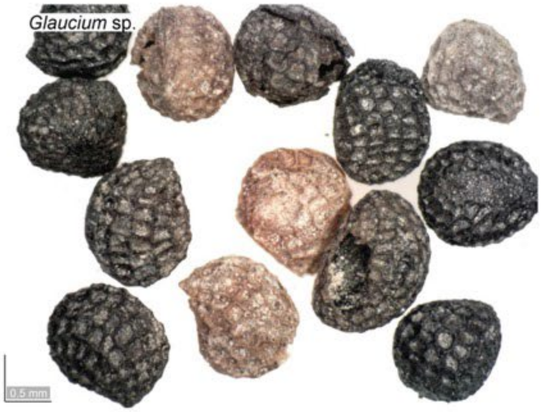
d

Fumaria sp.



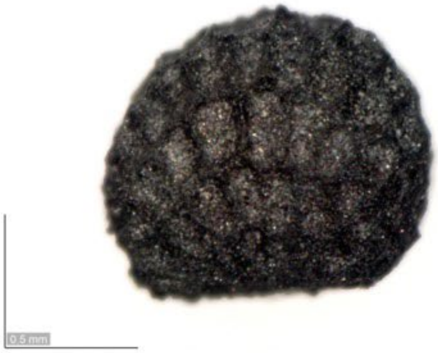
e

Glaucium sp.



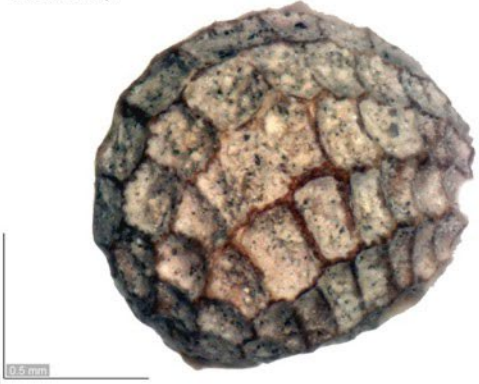
f

Glaucium sp.



g

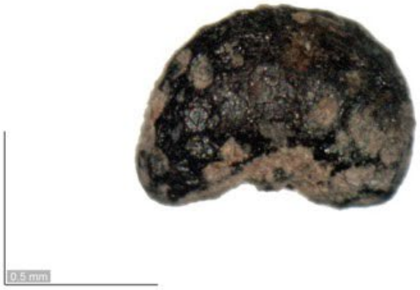
Glaucium sp.



h

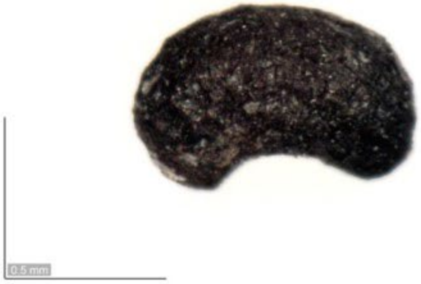
PLATE 23

Papaver sp.



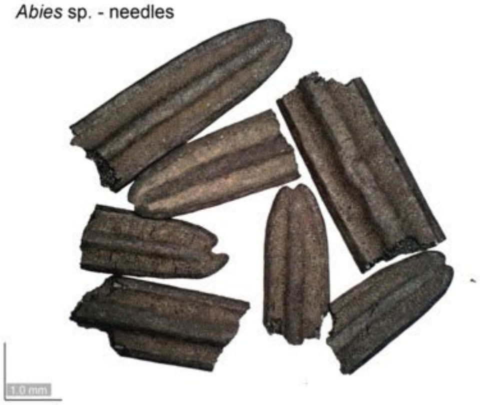
a

Papaver sp.



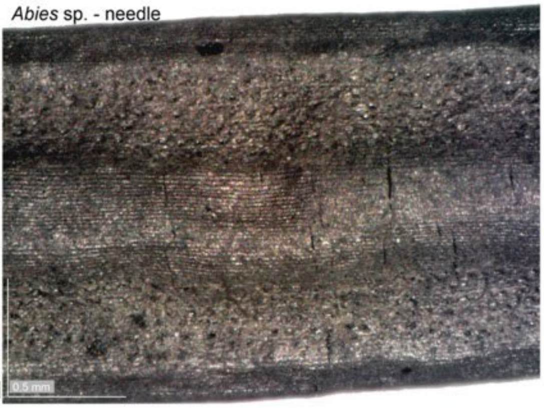
b

Abies sp. - needles



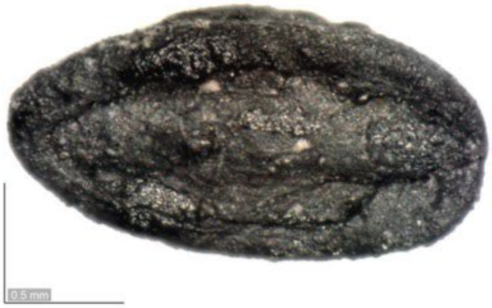
c

Abies sp. - needle



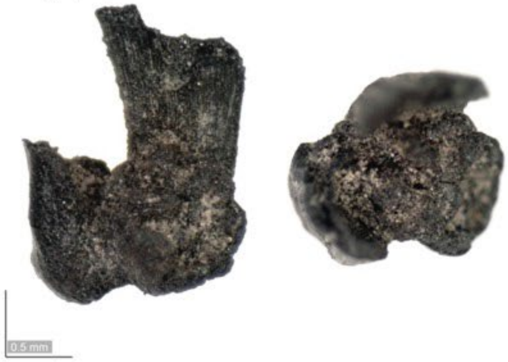
d

Plantago sp.



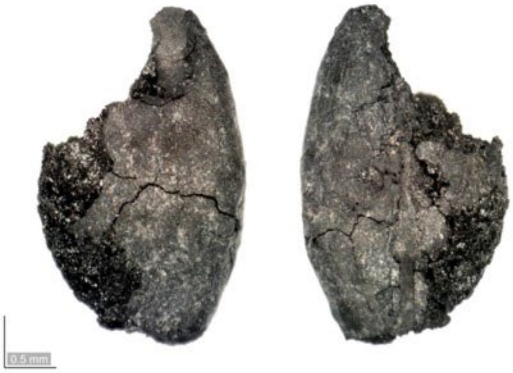
e

Aegilops sp. - rachis



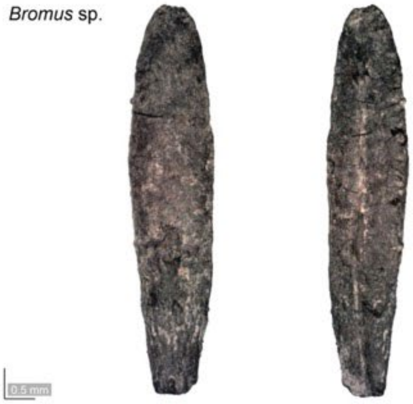
f

Aegilops sp.



g

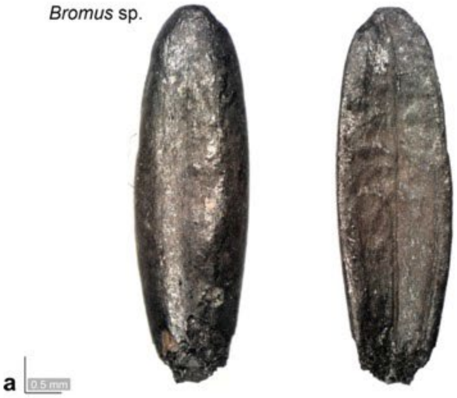
Bromus sp.



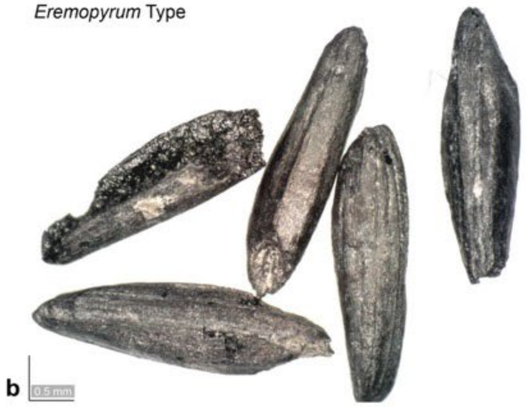
h

PLATE 24

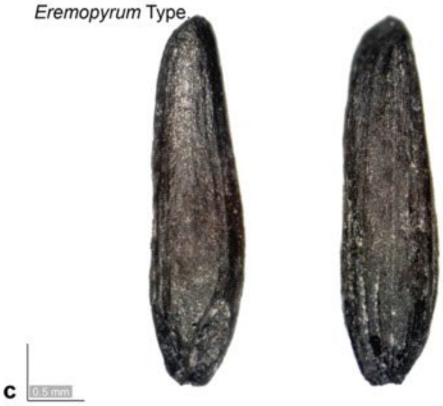
Bromus sp.



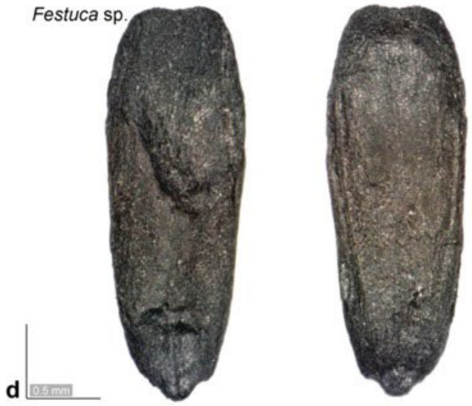
Eremopyrum Type



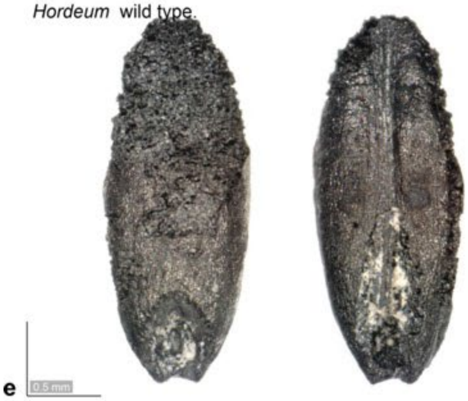
Eremopyrum Type



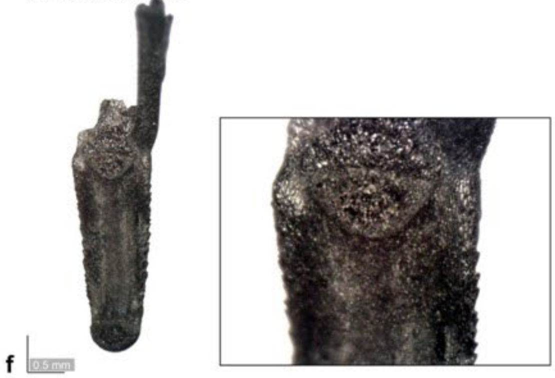
Festuca sp.



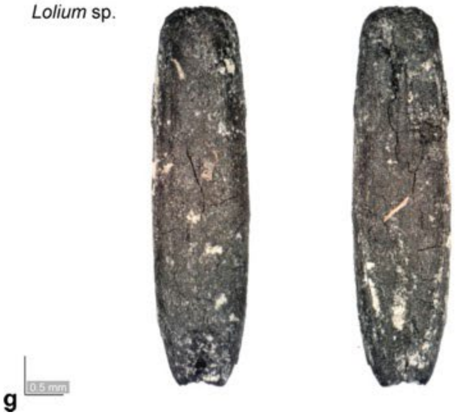
Hordeum wild type



Hordeum wild type



Lolium sp.



Lolium sp.

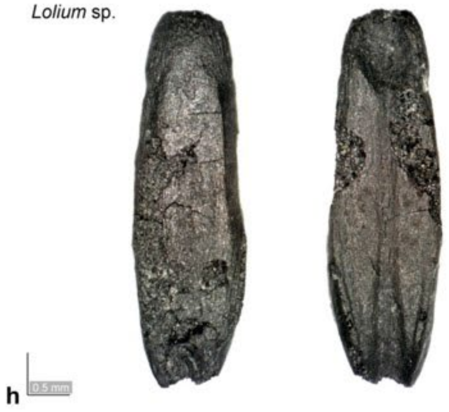
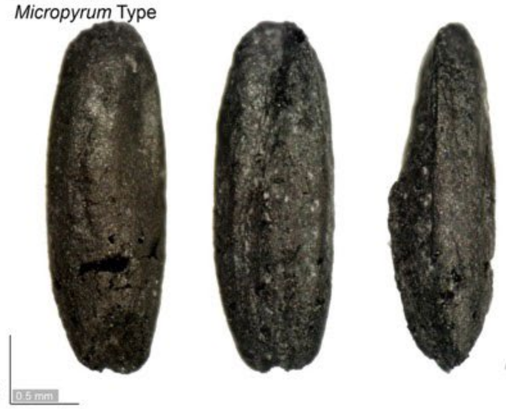


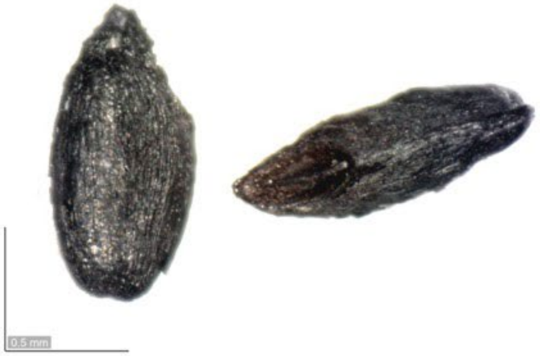
PLATE 25

Micropyrum Type



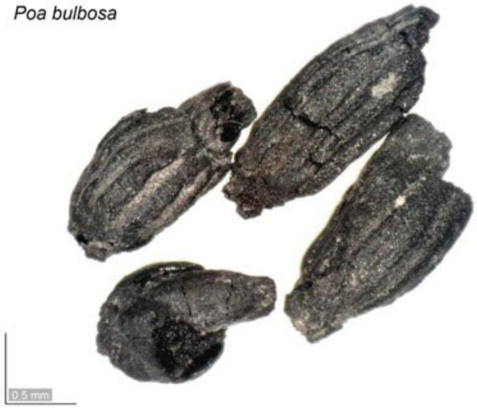
a

Phalaris sp.



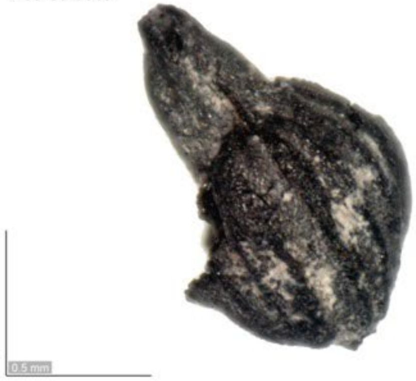
b

Poa bulbosa



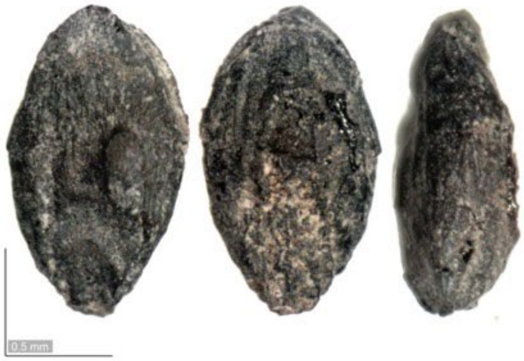
c

Poa bulbosa



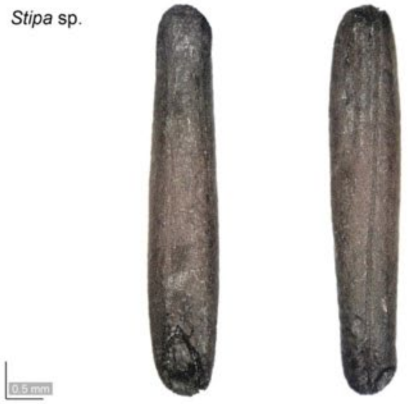
d

Setaria sp.



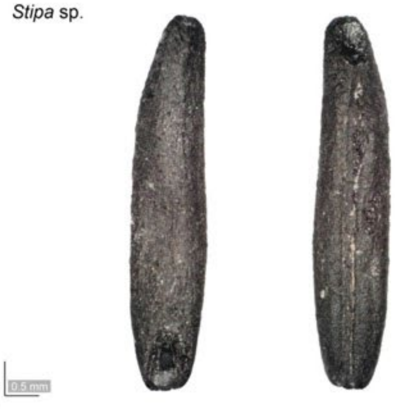
e

Stipa sp.



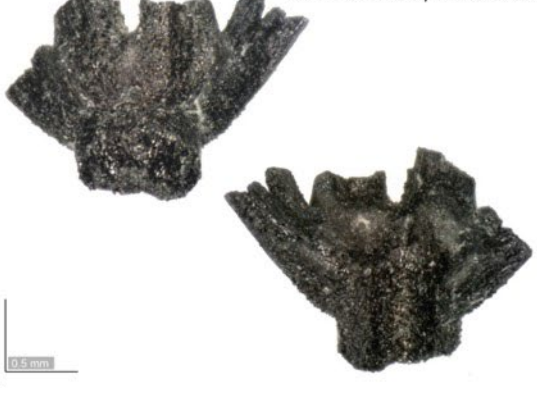
f

Stipa sp.



g

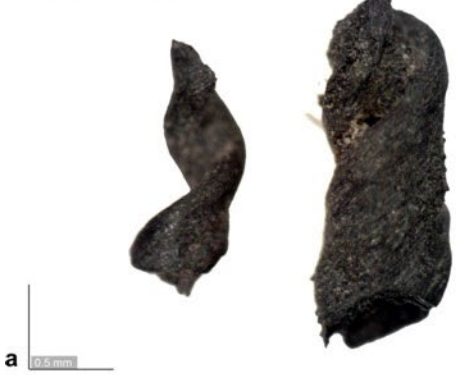
Taeniatherum caput-medusae



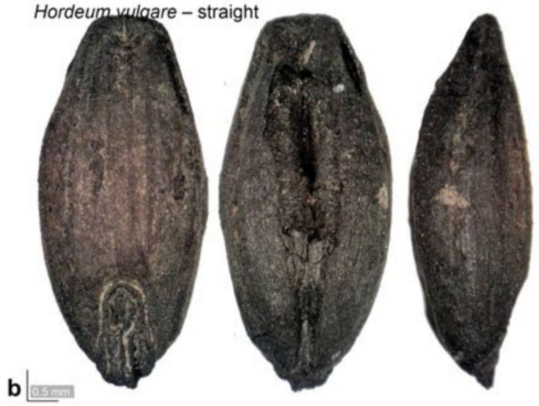
h

PLATE 26

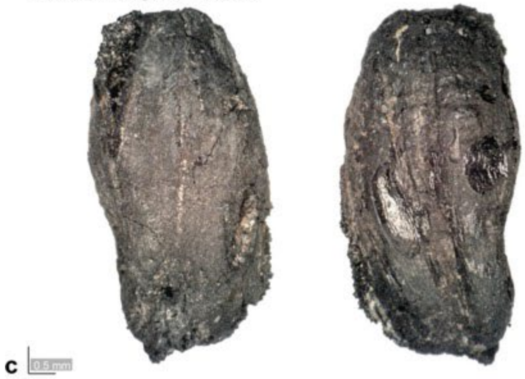
Poaceae – awns



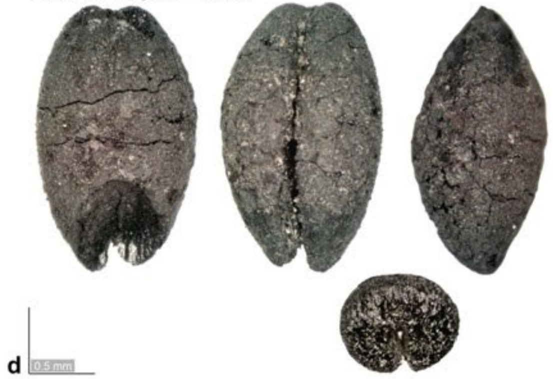
Hordeum vulgare – straight



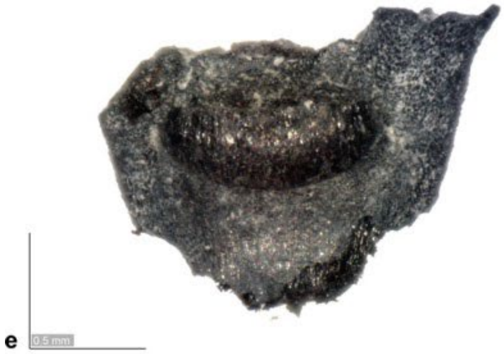
Hordeum vulgare – twisted



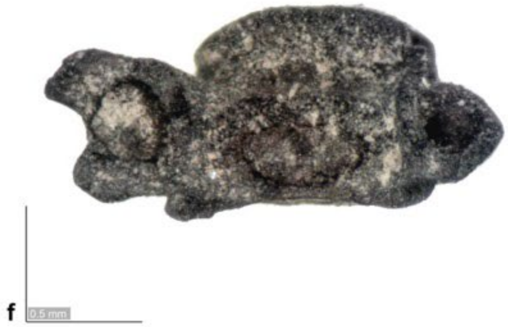
Hordeum vulgare – naked



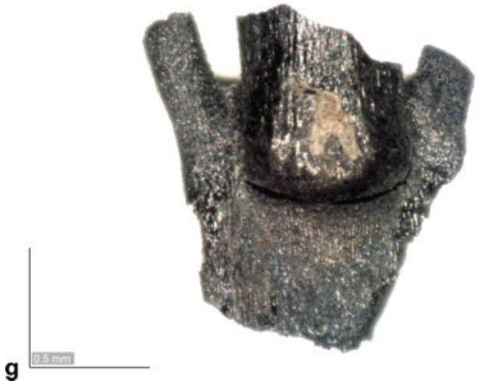
Hordeum vulgare spp. *vulgare*



Hordeum vulgare spp. *vulgare*



Hordeum vulgare spp. *distichon*



Hordeum vulgare spp. *distichon*

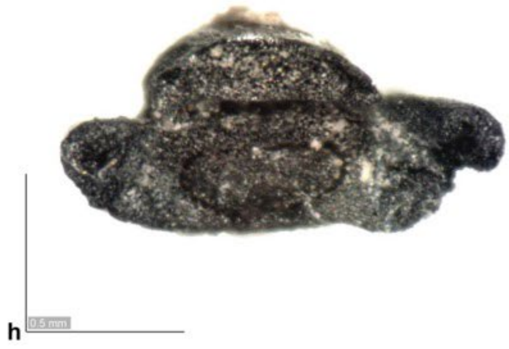
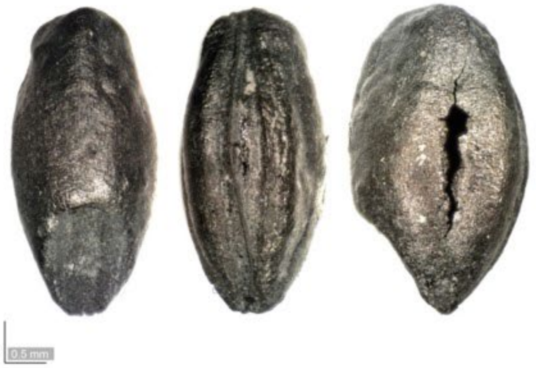


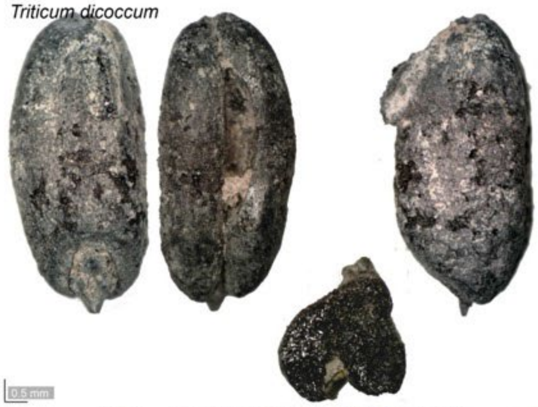
PLATE 27

Triticum monococcum



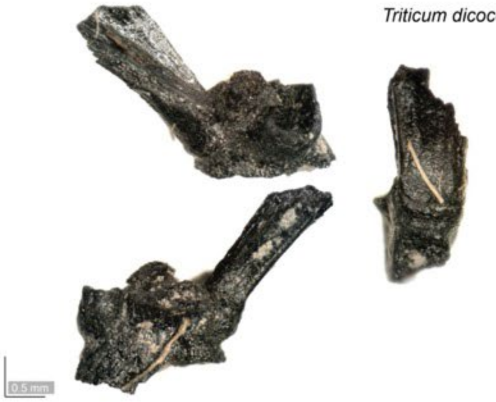
a

Triticum dicoccum



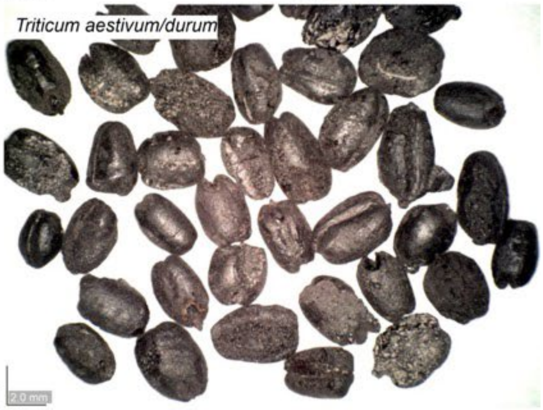
b

Triticum dicoccum



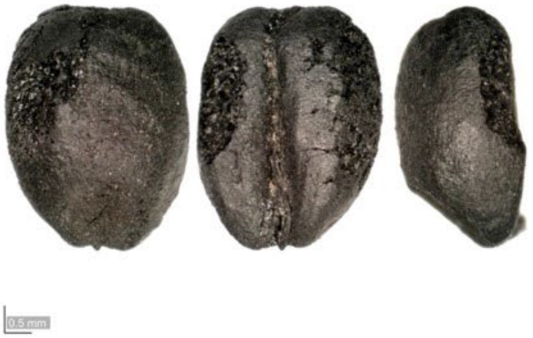
c

Triticum aestivum/durum



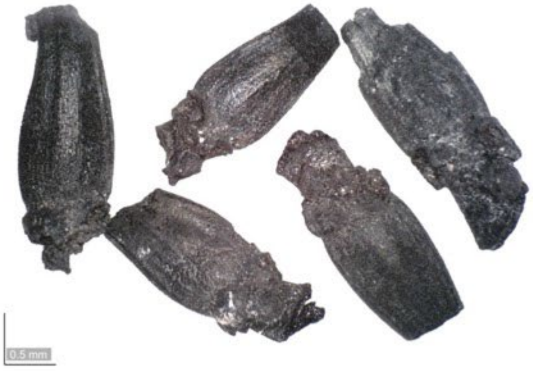
d

Triticum aestivum/durum



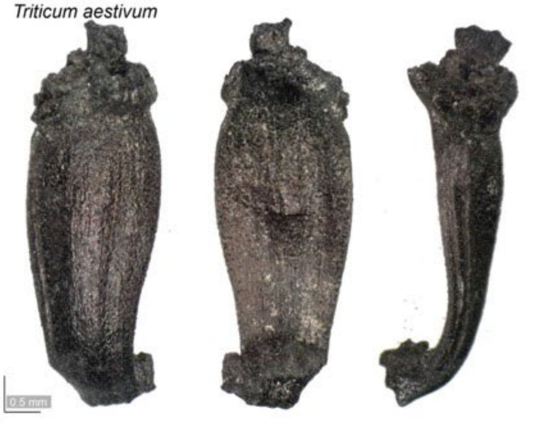
e

Triticum aestivum



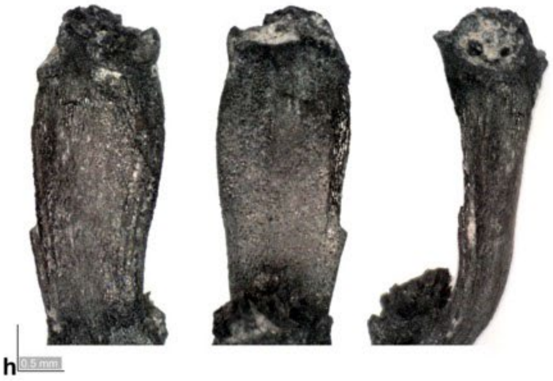
f

Triticum aestivum



g

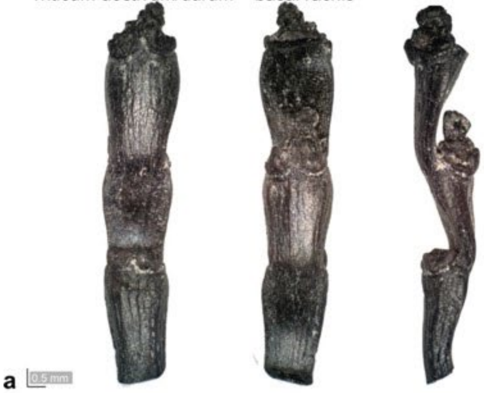
Triticum aestivum



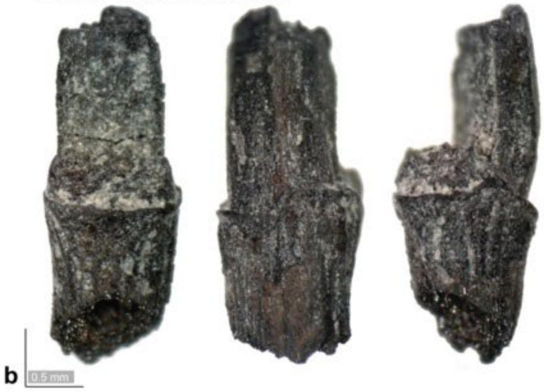
h

PLATE 28

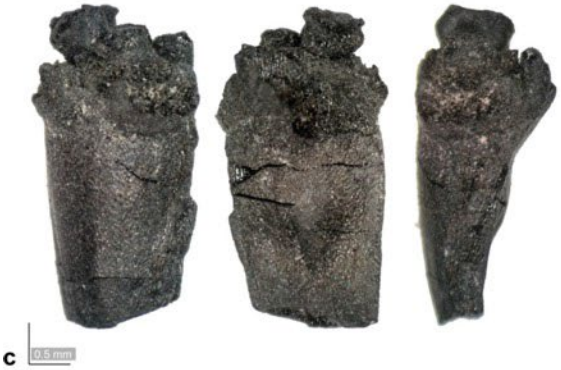
Triticum aestivum/durum – basal rachis



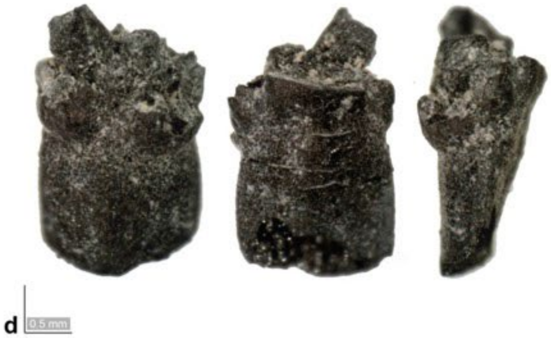
Cerealia – rachis first internode



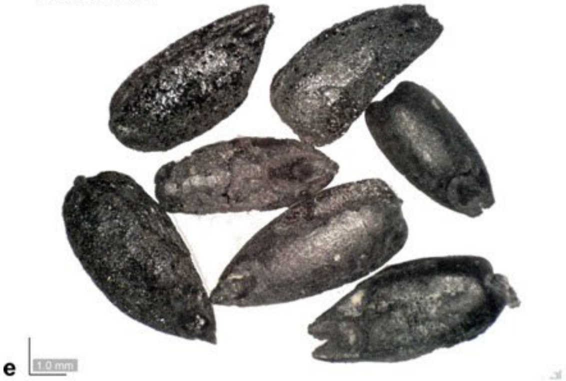
Triticum cf *durum* – rachis



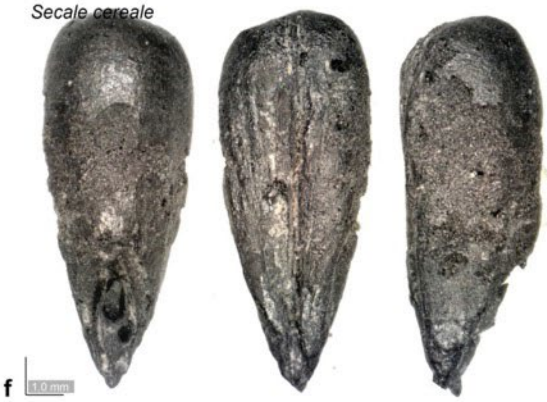
Triticum cf *durum* – rachis



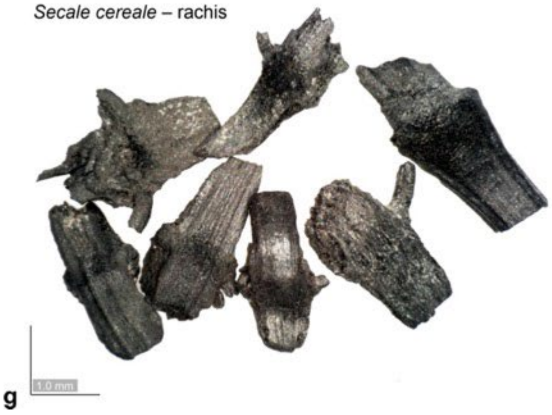
Secale cereale



Secale cereale



Secale cereale – rachis



Secale cereale – rachis

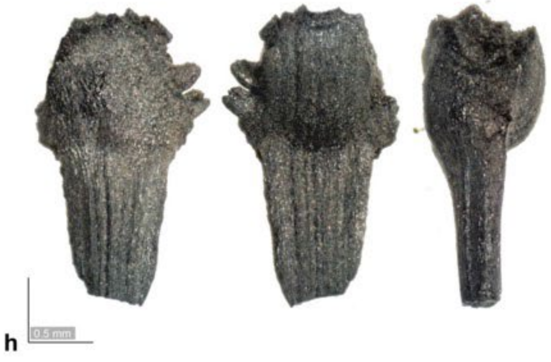
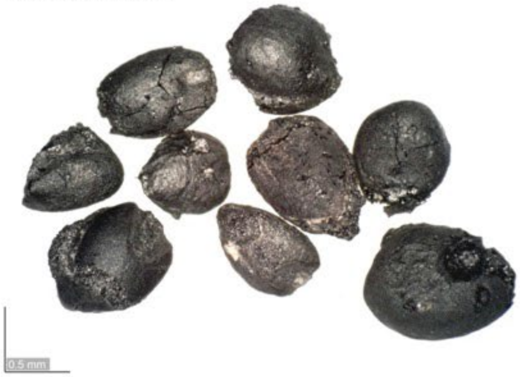


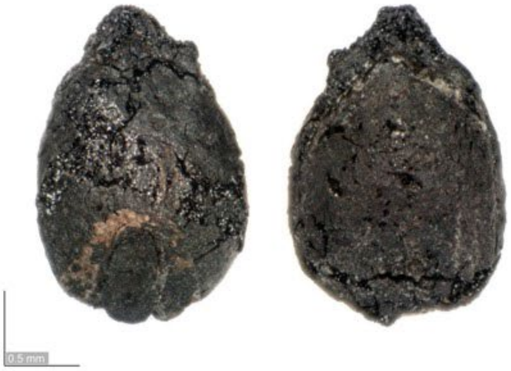
PLATE 29

Panicum miliaceum



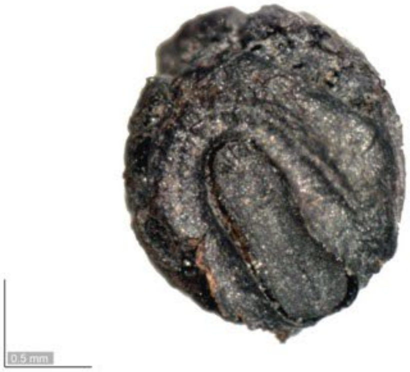
a

Panicum miliaceum



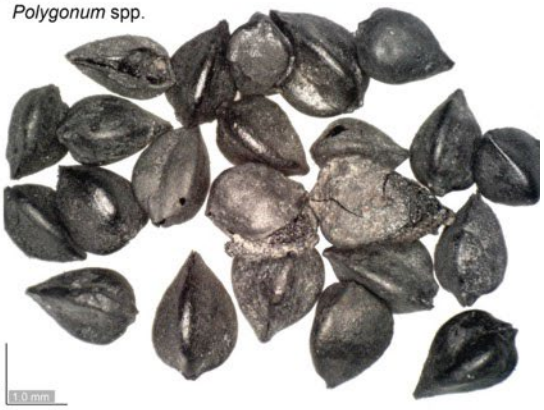
b

Setaria italica



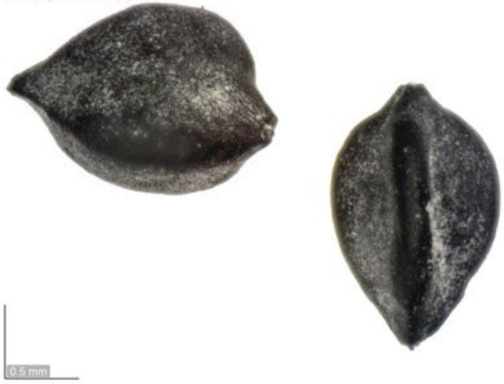
c

Polygonum spp.



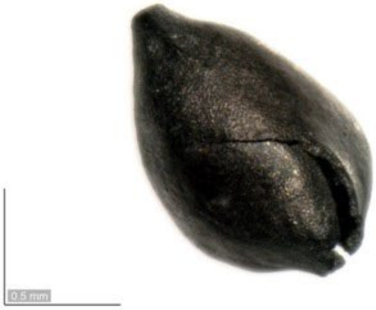
d

Polygonum spp.



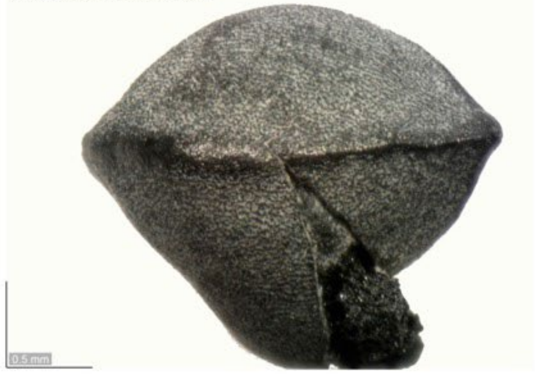
e

Polygonum aviculare Type



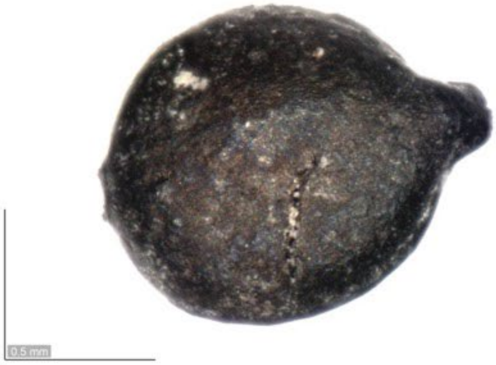
f

Polygonum convolvulus



g

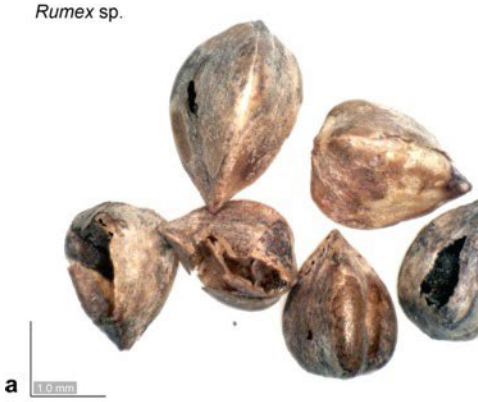
Persicaria Type



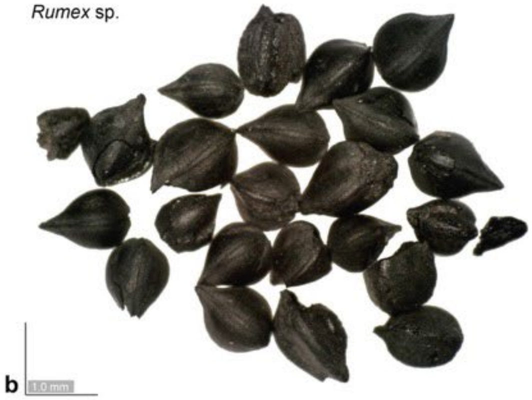
h

PLATE 30

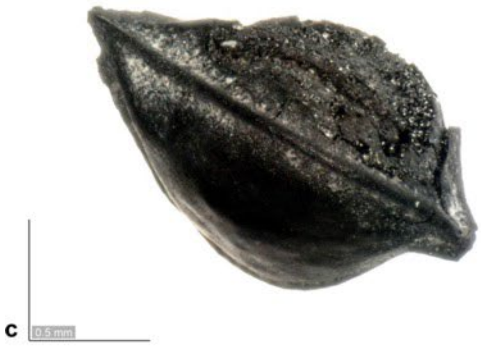
Rumex sp.



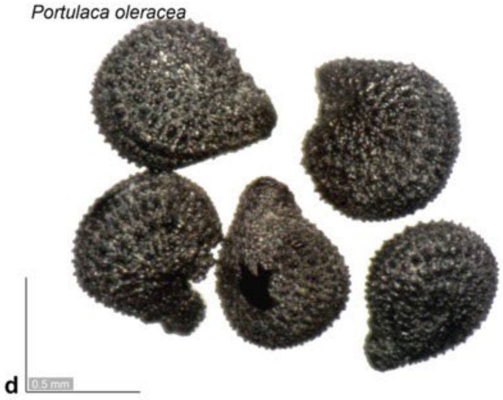
Rumex sp.



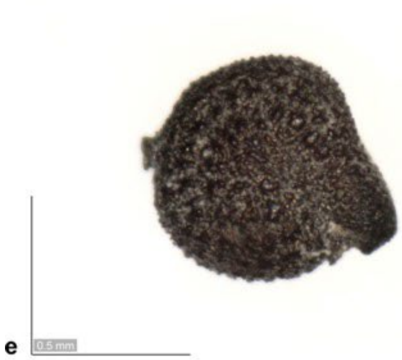
Rumex sp.



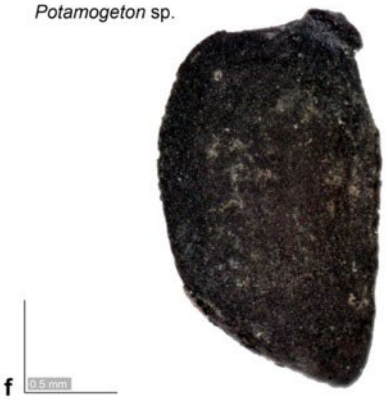
Portulaca oleracea



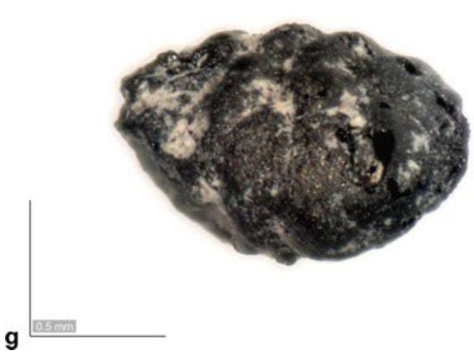
Portulaca oleracea



Potamogeton sp.



Androsace maxima



Adonis sp.

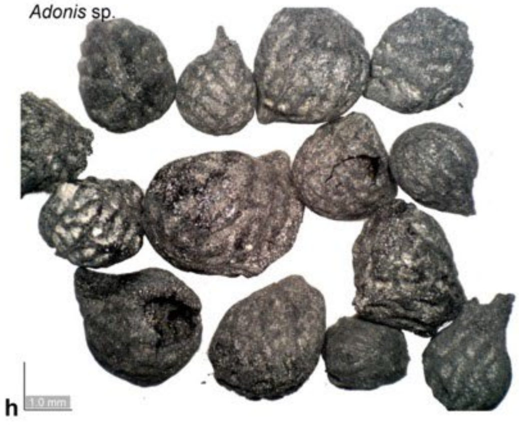
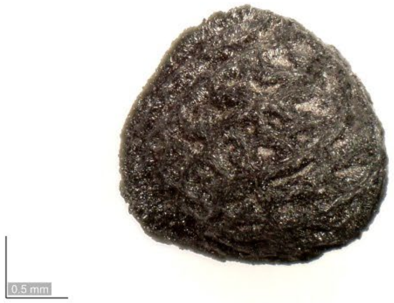


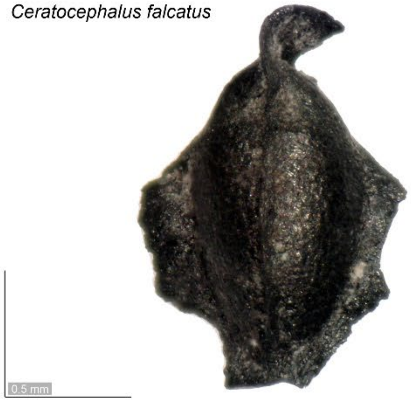
PLATE 31

Adonis sp.



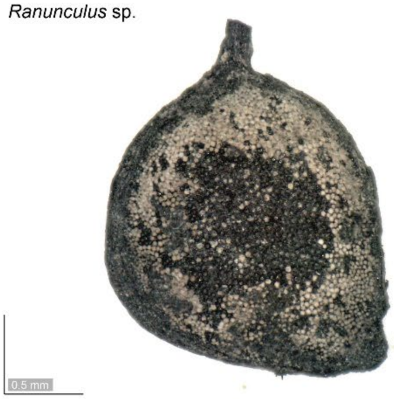
a

Ceratocephalus falcatus



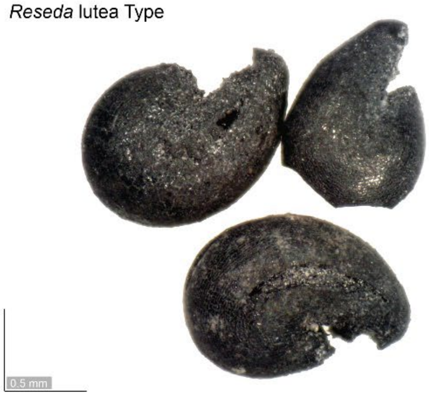
b

Ranunculus sp.



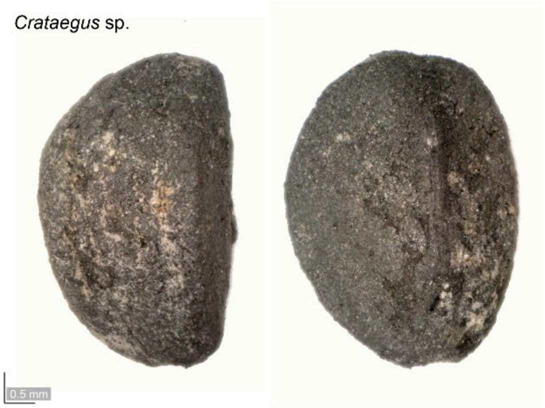
c

Reseda lutea Type



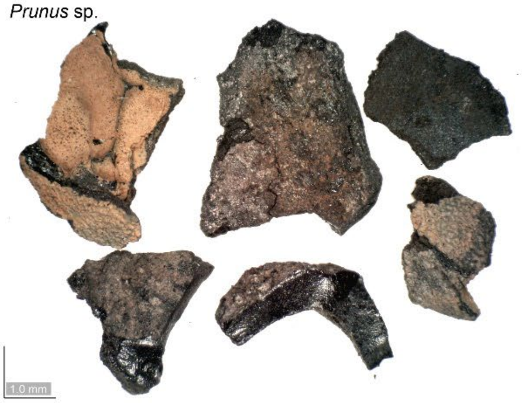
d

Crataegus sp.



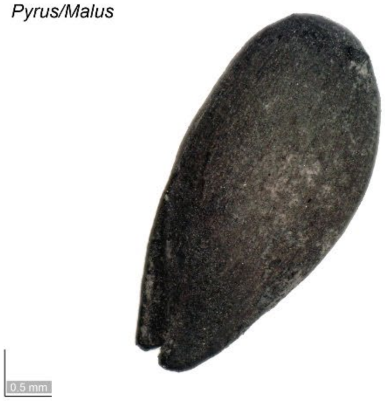
e

Prunus sp.



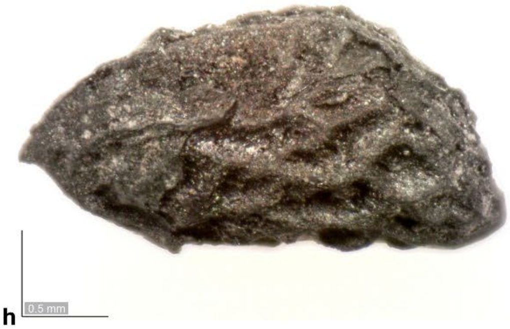
f

Pyrus/Malus



g

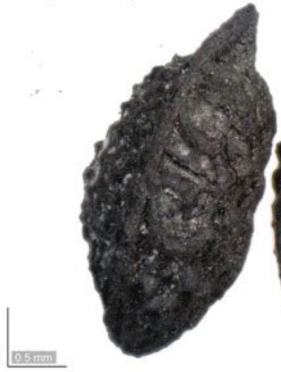
Rubus sp.



h

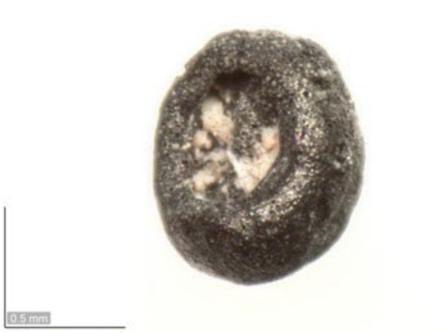
PLATE 32

Sanguisorba sp.



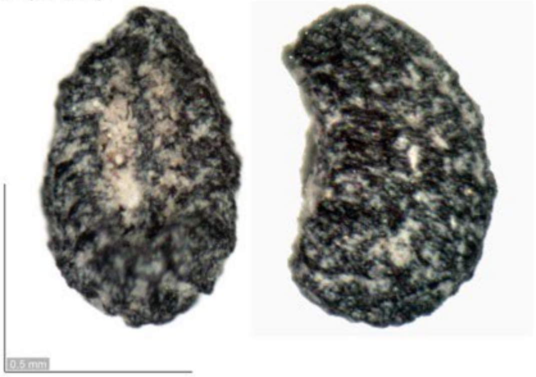
a

Asperula arvensis/orientalis



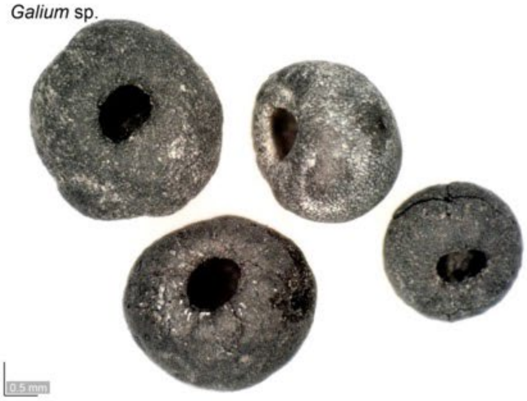
b

Asperula sp.



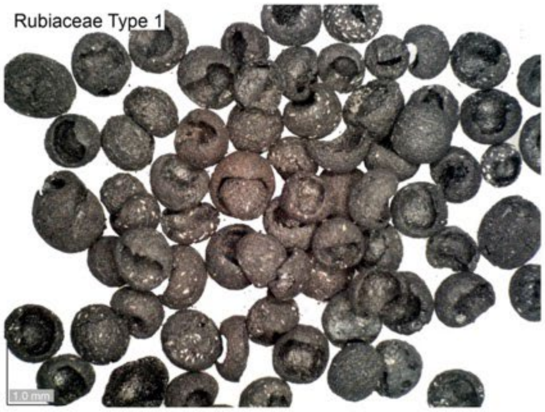
c

Galium sp.



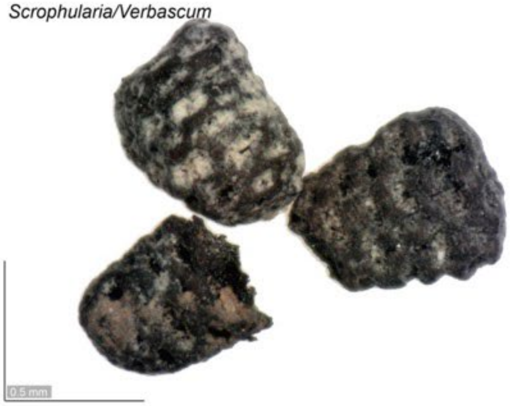
d

Rubiaceae Type 1



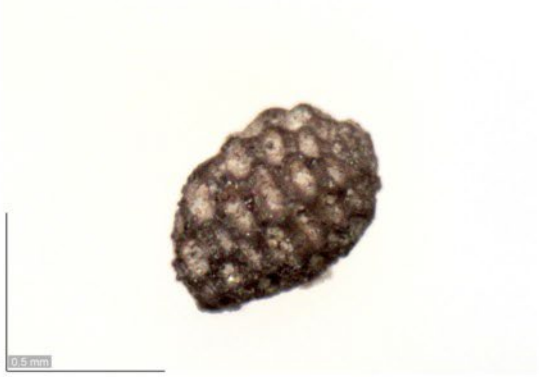
e

Scrophularia/Verbascum



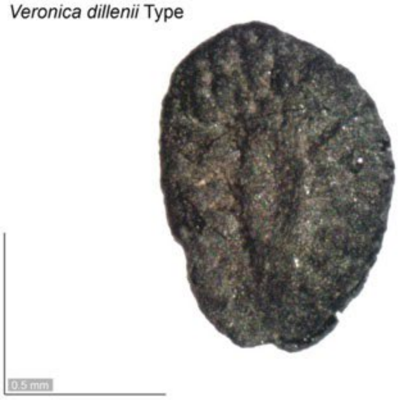
f

Scrophularia/Verbascum



g

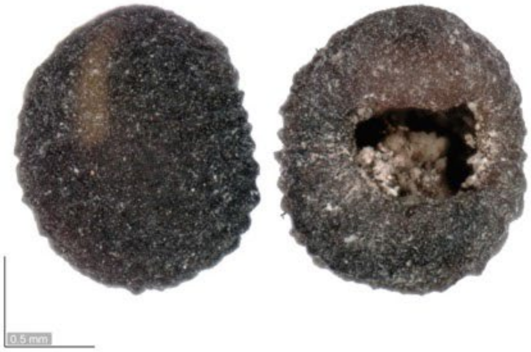
Veronica dillenii Type



h

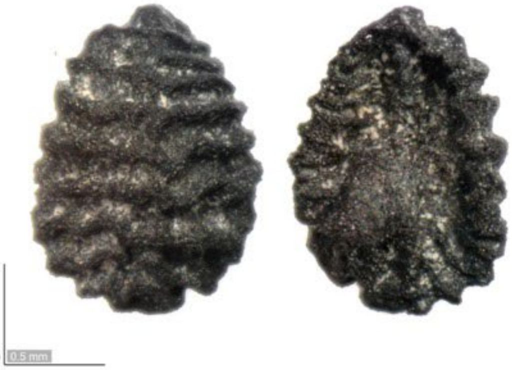
PLATE 33

Veronica hederifolia



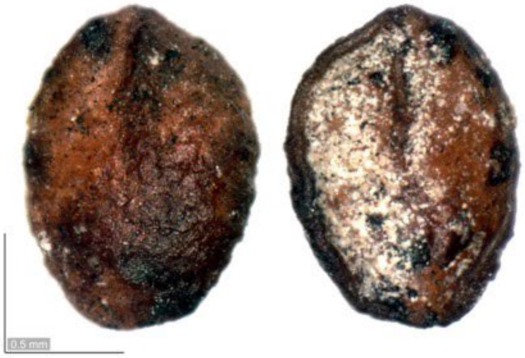
a

Veronica polita Type



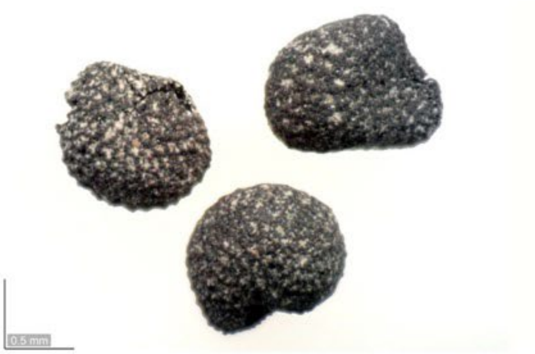
b

Veronica triphyllos



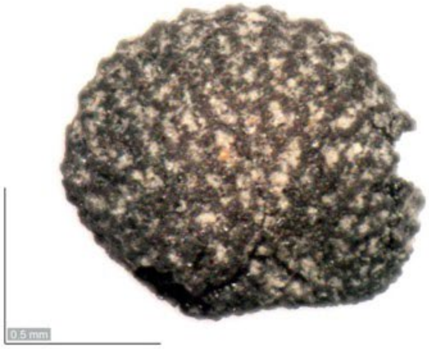
c

Hyoscyamus sp.



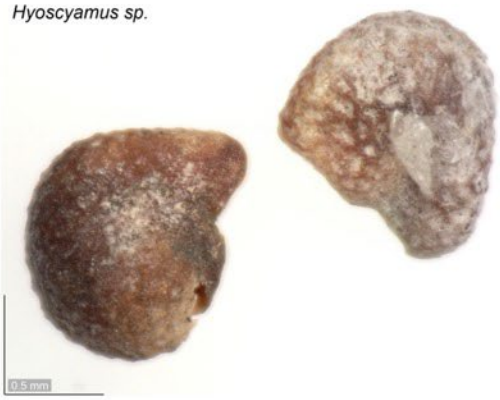
d

Hyoscyamus sp.

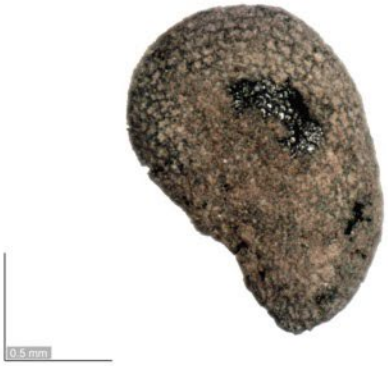


e

Hyoscyamus sp.

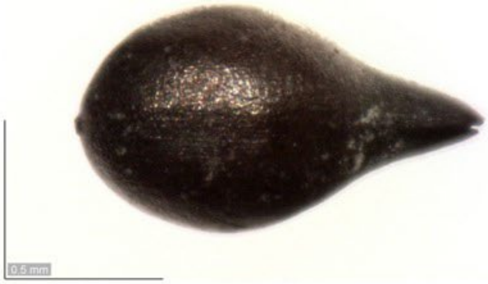


f



g

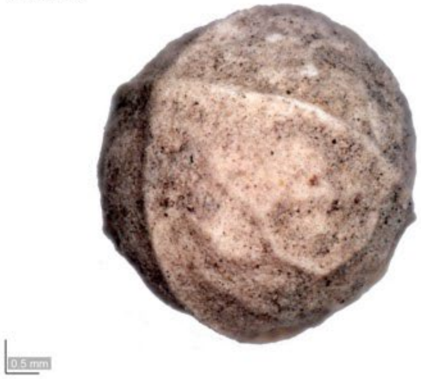
Thymelaea sp.



h

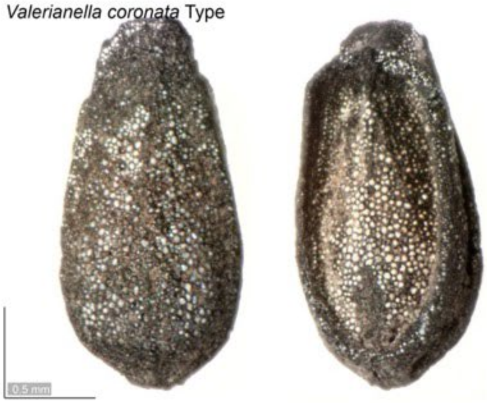
PLATE 34

Celtis sp.



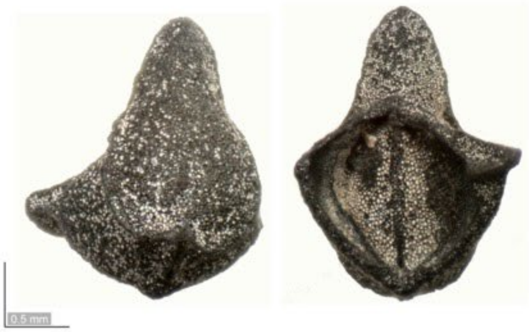
a

Valerianella coronata Type



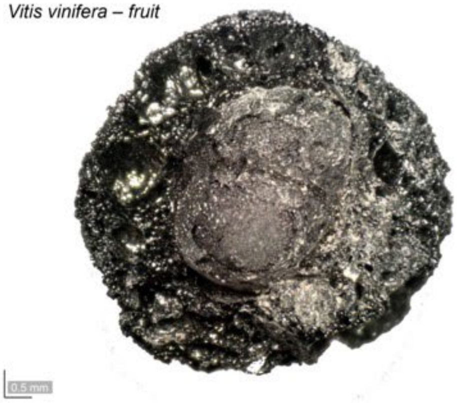
b

Valerianella vesicaria Type



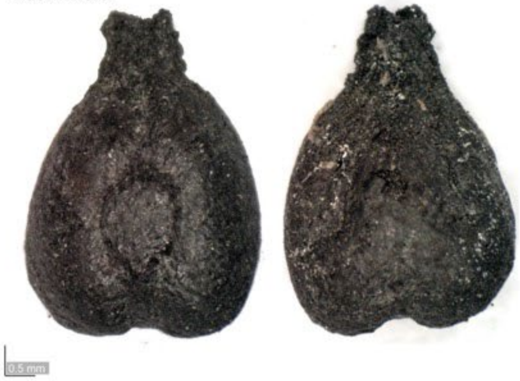
c

Vitis vinifera – fruit



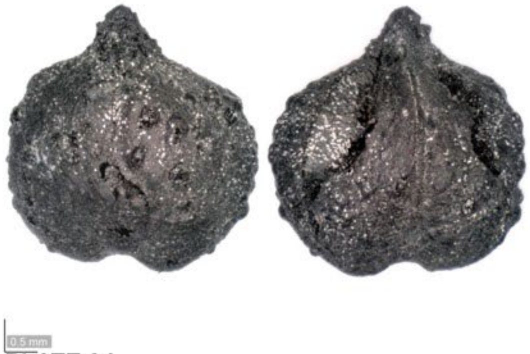
d

Vitis vinifera



e

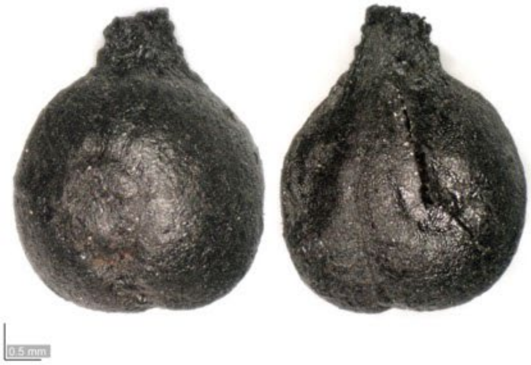
Vitis vinifera



f

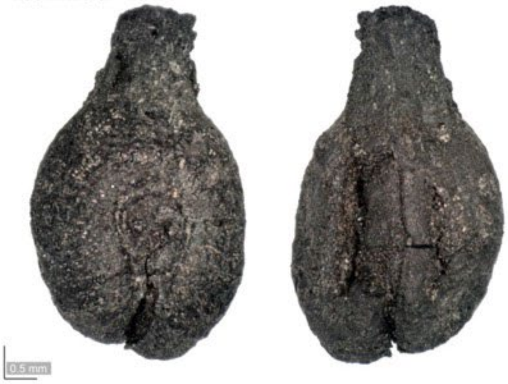
PLATE 34

Vitis vinifera



g

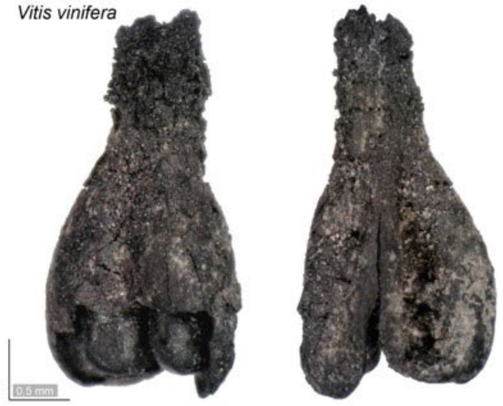
Vitis vinifera



h

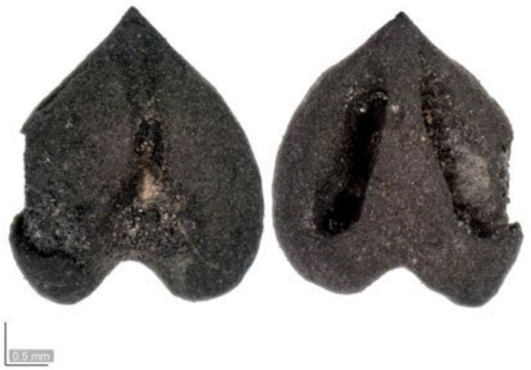
PLATE 35

Vitis vinifera



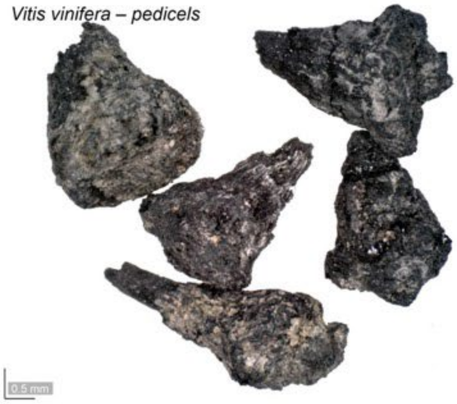
a

Vitis vinifera – endosperm



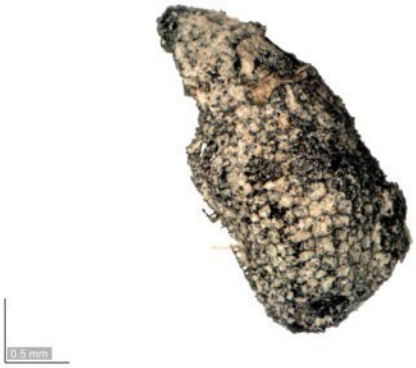
b

Vitis vinifera – pedicels

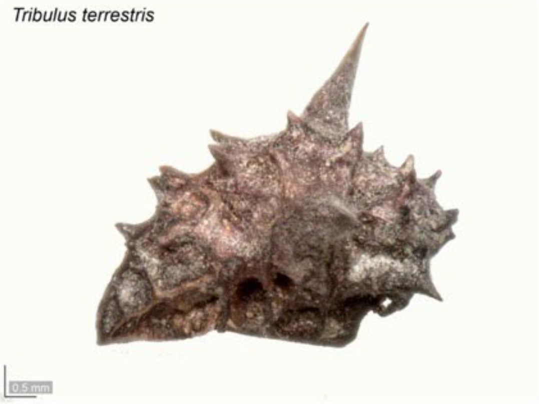


c

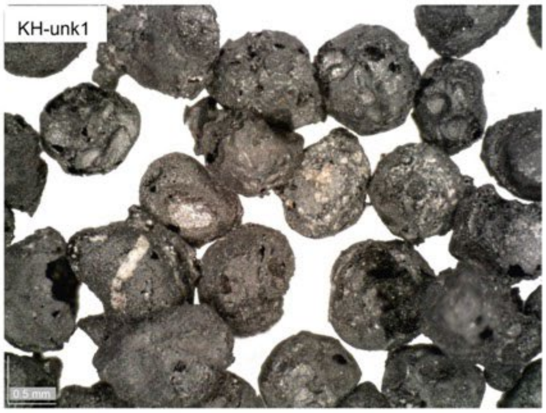
Peganum harmala



d

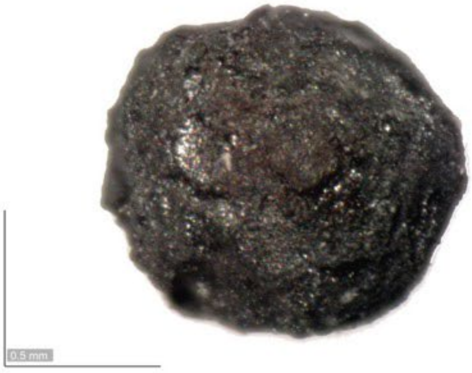

Tribulus terrestris

e


KH-unk1

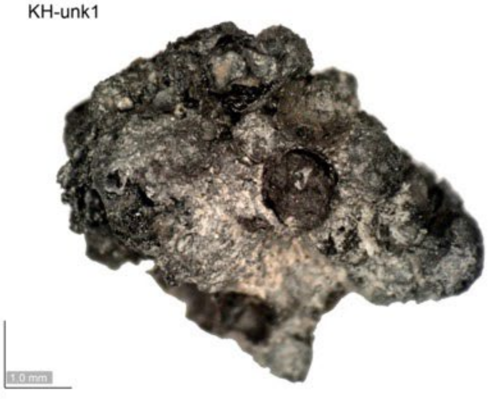
f

KH-unk1



g

KH-unk1



h

PLATE 36

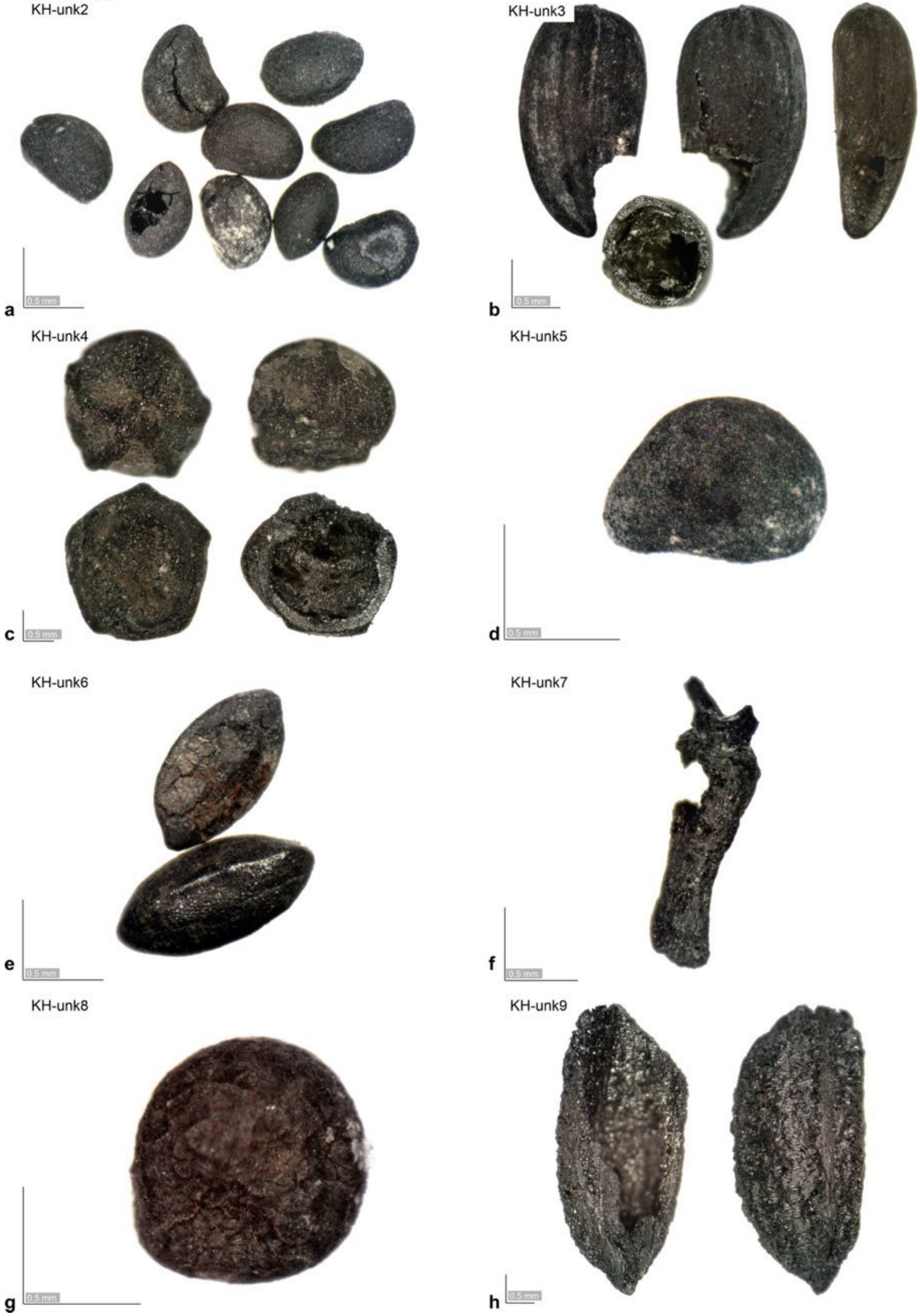
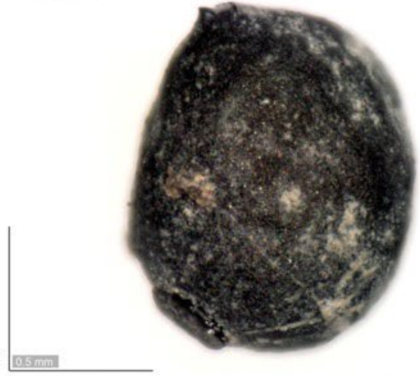

KH-unk2
a
0.5 mm
KH-unk3
b
0.5 mm
KH-unk4
c
0.5 mm
KH-unk5
d
0.5 mm
KH-unk6
e
0.5 mm
KH-unk7
f
0.5 mm
KH-unk8
g
0.5 mm
KH-unk9
h
0.5 mm

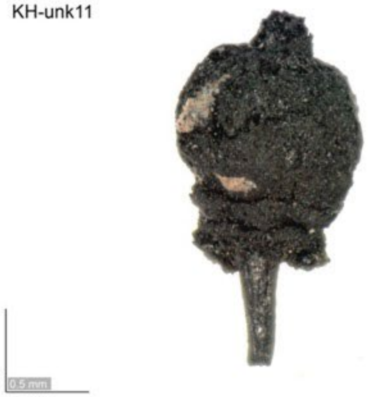
PLATE 37

KH-unk10



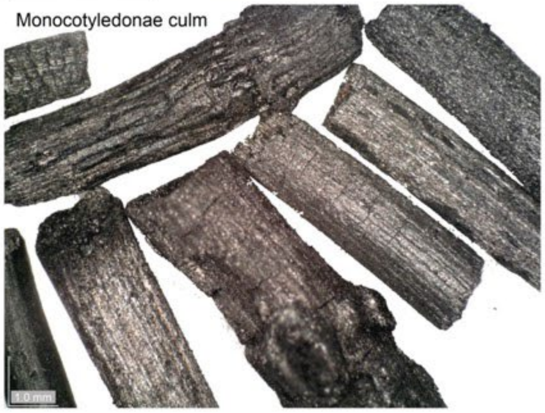
a

KH-unk11



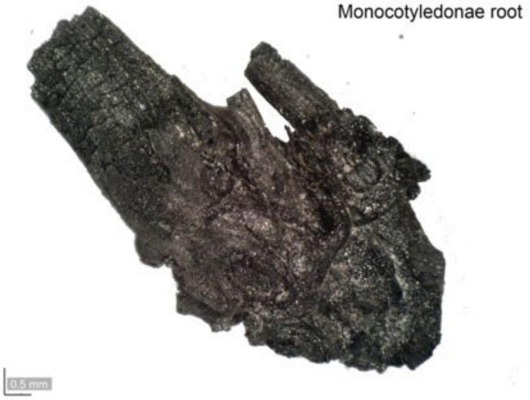
b

Monocotyledonae culm



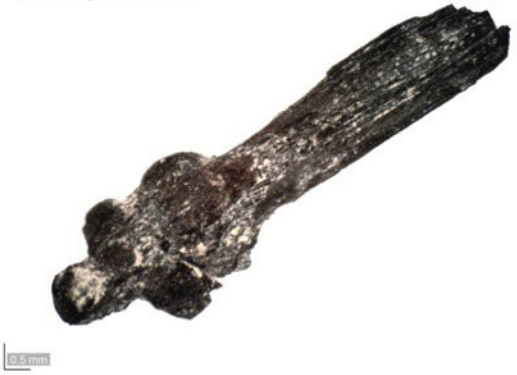
c

Monocotyledonae root



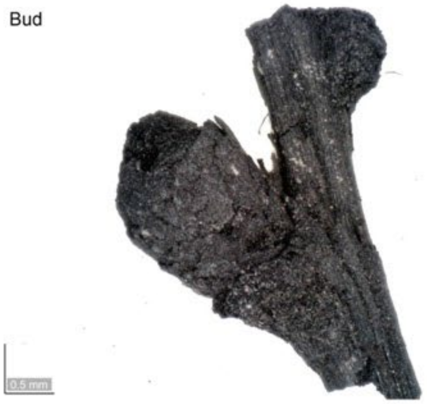
d

Monocotyledonae root



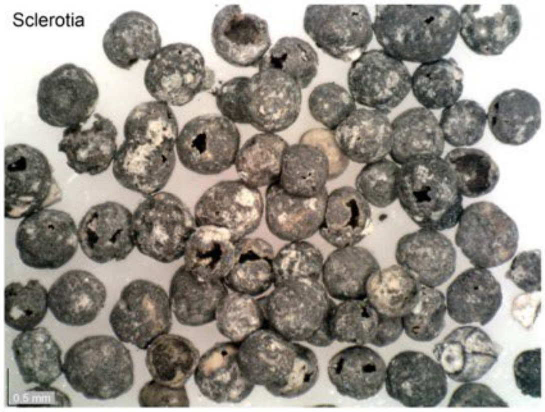
e

Bud



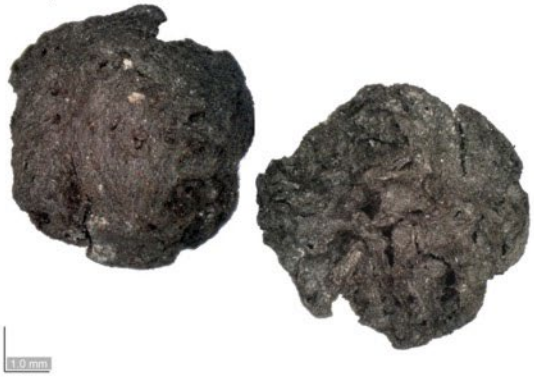
f

Sclerotia



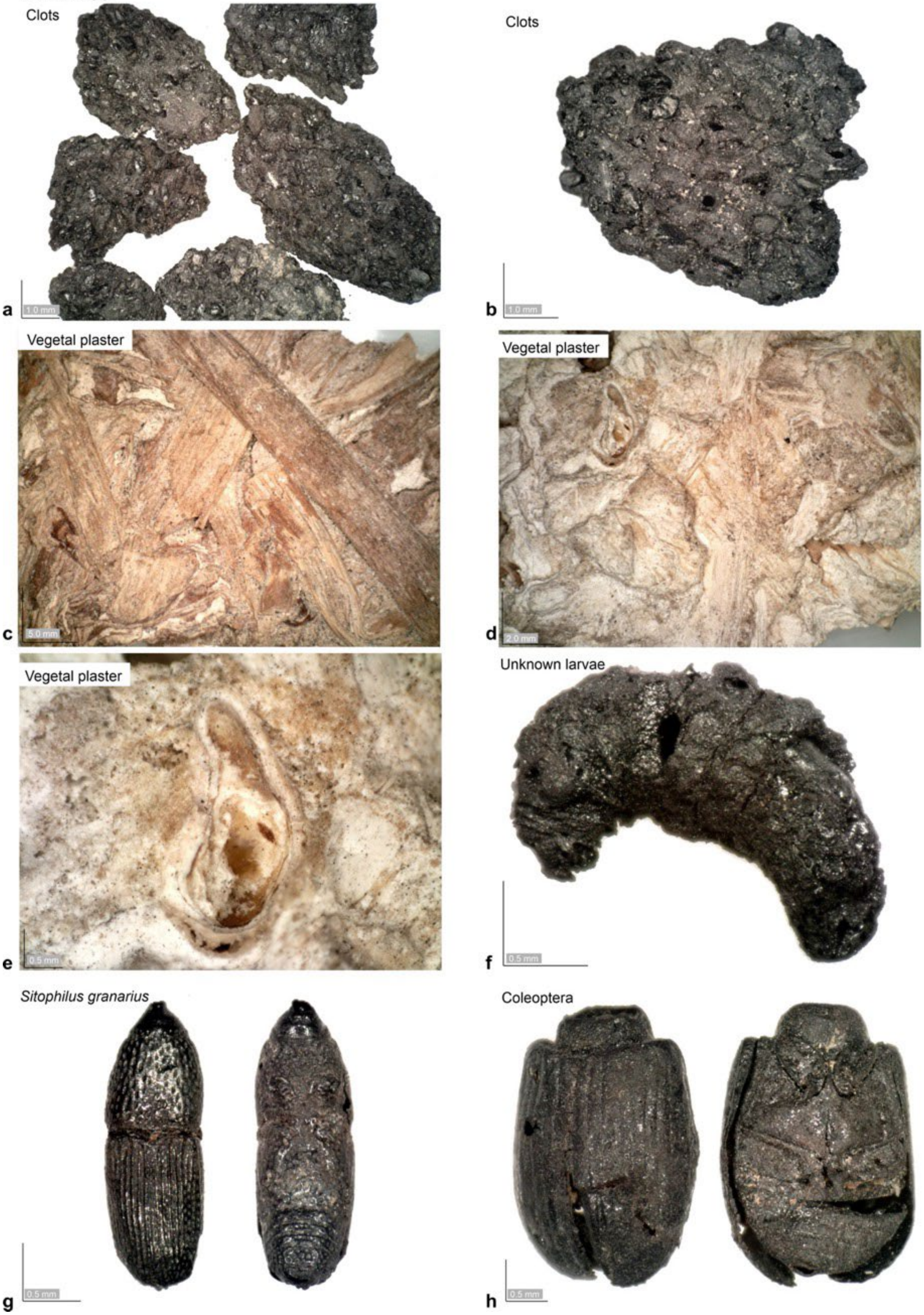
g

Sheep-Goat dung pellet



h

PLATE 38


Clots
a
1.0 mm
Clots
b
1.0 mm
Vegetal plaster
c
5.0 mm
Vegetal plaster
d
2.0 mm
Vegetal plaster
e
0.5 mm
Unknown larvae
f
0.5 mm
Sitophilus granarius
g
0.5 mm
Coleoptera
h
0.5 mm

APPENDIX 7

Carpological analysis of samples from Niğde-Kınık Höyük: sample-by-sample count and weight data

In this appendix I provide the sample-by-sample results of the carpological study presented in Chapter 6. For the absolute dating of the Niğde-Kınık Höyük periods see Chapter 3 (in particular Table 3.1). Information on samples preparations and metrics are provided in Appendix 3. For identification criteria and candidate taxa in the Turkish flora, see Appendix 6. Taxonomy is based on the Flora o Turkey (Davis 1965-1985).

				KIN13B727s417	KIN14B855s4	KIN14B865s17	KIN13B638s60	KIN13B644s67	KIN12B488s18	KIN14B870s23
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a
			context type	debris	layer	layer	pit fill	pit fill	pyro.	pyro.
			soil volume (l)	3.5	9.25	9.5	6	16	3.5	7.8
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	—	P	—	P	P	P	P
	Cerealia	weight	caryopsis	—	0.029	—	<0.001	0.168	<0.001	0.008
	Cerealia	count	germ	—	—	—	—	1	—	—
Barley	*Hordeum vulgare*	count	caryopsis	P	—	1	1	19	1	1
	Hordeum vulgare	weight	caryopsis	0.017	—	0.006	0.013	0.176	0.007	0.005
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	—	—	—
	Triticum sp.	weight	caryopsis	—	—	—	—	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	—	2	1	2	9	2	1
	Triticum aestivum /durum	weight	caryopsis	—	0.012	<0.001	0.012	0.043	0.015	0.006
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	1	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	0.005	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	1	2	—	—
	Secale cereale	weight	caryopsis	—	—	—	0.008	0.015	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	2	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	<0.001	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	0.023	0.008	0.017	0.019	—	0.058
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	1	1	1	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	1	11	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	—	12	1	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	2	—	3	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	1	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	—	—	3	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	1	—	1	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	—	—	—	—	—
	Pulse indeterminable	weight	seed	—	—	—	—	—	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	1	—	—
	Lens culinaris	weight	seed	—	—	—	—	<0.001	—	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN13B727s417	KIN14B855s4	KIN14B865s17	KIN13B638s60	KIN13B644s67	KIN12B488s18	KIN14B870s23
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a
			context type	debris	layer	layer	pit fill	pit fill	pyro.	pyro.
			soil volume (l)	3.5	9.25	9.5	6	16	3.5	7.8
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	1	—	—	—	—
	Vicia ervilia	weight	seed	—	—	0.015	—	—	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	P	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	0.005	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	1	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	<0.001	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	2	1	—	3	—	P
	Vitis vinifera	weight	seed	—	0.022	0.006	—	0.029	—	0.005
	Vitis vinifera	count	pedicel	—	—	—	—	1	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

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			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a
			context type	debris	layer	layer	pit fill	pit fill	pyro.	pyro.
			soil volume (l)	3.5	9.25	9.5	6	16	3.5	7.8
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	2	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	2	1	—	—	—	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	1	—	1	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	1
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	2	—	1	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	1	—	—
	Chenopodium sp.	count	seed	1	1	2	1	2	—	2
	Salsola sp.	count	seed	—	—	—	—	—	—	1
	Suaeda sp.	count	seed	—	—	1	1	—	—	—
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	—	—	—	—	—	1
	Cyperaceae s.l.	count	endosperm	—	1	—	5	—	—	—
	Bolboschoenus glaucus	count	achene	—	—	—	—	—	—	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	—	—	—	5	—	—	1
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	1	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

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			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a
			context type	debris	layer	layer	pit fill	pit fill	pyro.	pyro.
			soil volume (l)	3.5	9.25	9.5	6	16	3.5	7.8
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	1
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	2	—	—	2	1	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	—	—	—	—	—	—
	Melilotus- type	count	seed	—	—	—	1	—	—	1
	Trifolium- type	count	seed	—	—	—	—	—	—	—
	Trigonella- type	count	seed	—	—	—	—	1	—	1
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	1	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	3	1	—	—	—	—	—
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	1	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	1	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	1	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	10
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	1	—	—	—	—	1
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	1	—	—

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			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a
			context type	debris	layer	layer	pit fill	pit fill	pyro.	pyro.
			soil volume (l)	3.5	9.25	9.5	6	16	3.5	7.8
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	1
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	—	—	—	1	—	—	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	2	—	—	—	1
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	—	—	—	—	—	1
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	—	—	—	5	—	—	1
	KH-unk1	count	—	—	—	—	—	—	—	—
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	—	—	6	—	1	—	1
	Indeterminable fragments	weight	—	—	<0.001	—	—	<0.001	<0.001	0.005
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN13B727s417	KIN14B855s4	KIN14B865s17	KIN13B638s60	KIN13B644s67	KIN12B488s18	KIN14B870s23
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a	B.1a
			context type	debris	layer	layer	pit fill	pit fill	pyro.	pyro.
			soil volume (l)	3.5	9.25	9.5	6	16	3.5	7.8
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	41.035	0.452	1.731	1.247	2.285	0.722	2.812
	Wood charcoal >4mm	weight	wood	85.73	0.1	0.78	0.37	0.19	1.02	1.23
	Amorphous material	weight	unknwon	—	—	—	0.038	0.303	—	0.016
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	0.036	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	<0.001	—	—	1	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	2	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	198	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN15B860s15	KIN12B522s96	KIN12B562s158	KIN12B563s160	KIN13B617s26	KIN14B856s3	KIN12B540s130
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a-b	B.1a-b	B.1a-b	B.1b	B.1b	B.1b
			context type	surface	pit fill	pit fill	pit fill	layer	layer	pit fill
			soil volume (l)	10	10	10	1	10	6.5	10
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	—	P	P	P
	Cerealia	weight	caryopsis	<0.001	0.209	0.015	—	0.079	0.056	0.033
	Cerealia	count	germ	—	1	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	—	47	P	—	8	—	1
	Hordeum vulgare	weight	caryopsis	—	0.574	0.01	—	0.076	—	0.013
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	P	—	—	—	4	—	—
	Triticum sp.	weight	caryopsis	<0.001	—	—	—	0.012	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	5	19	1	—	—	—	2
	Triticum aestivum /durum	weight	caryopsis	0.039	0.135	0.011	—	—	—	0.023
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	2	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	0.008	—	—
Rye	*Secale cereale*	count	caryopsis	—	4	—	—	2	1	—
	Secale cereale	weight	caryopsis	—	0.017	—	—	0.012	0.005	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	0.079	<0.001	—	—	—	0.011
Cereals undif.	Cerealia	count	rachis segment frg	—	6	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	1	—	—	—	1	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	150	2	—	10	—	1
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	1	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	1	6	—	—	1	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	7	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	13	—	—	—	—	—
	Triticum aestivum	count	rachis segment	—	3	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	19	—	—	2	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	1.5	—	1	—	0.5
	Pulse indeterminable	weight	seed	—	—	0.013	—	0.005	—	<0.001
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	—	—
	Lens culinaris	weight	seed	—	—	—	—	—	—	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN15B860s15	KIN12B522s96	KIN12B562s158	KIN12B563s160	KIN13B617s26	KIN14B856s3	KIN12B540s130
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a-b	B.1a-b	B.1a-b	B.1b	B.1b	B.1b
			context type	surface	pit fill	pit fill	pit fill	layer	layer	pit fill
			soil volume (l)	10	10	10	1	10	6.5	10
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	4.5	—	—	—	1	—
	Vicia ervilia	weight	seed	—	0.034	—	—	—	0.005	—
Vetch/field pea	*Vicia* /*Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /*Lathyrus*	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus* /*Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /*Malus*	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	1	—	—	P	P	1
	Vitis vinifera	weight	seed	—	0.007	—	—	0.012	<0.001	0.008
	Vitis vinifera	count	pedicel	—	1	—	—	—	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	1	—	—	1	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	1	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	2	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN15B860s15	KIN12B522s96	KIN12B562s158	KIN12B563s160	KIN13B617s26	KIN14B856s3	KIN12B540s130
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a-b	B.1a-b	B.1a-b	B.1b	B.1b	B.1b
			context type	surface	pit fill	pit fill	pit fill	layer	layer	pit fill
			soil volume (l)	10	10	10	1	10	6.5	10
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	1	—	—	—	—	—
	Echium sp.	count	nutlet	—	1	—	—	4	—	—
	Heliotropium sp.	count	nutlet	—	3	—	—	—	—	2
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	2	6	—	—	—	1	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	2	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	2	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	3	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	1	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	1	34	—	—	4	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	17	—	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	4	125	—	—	27	—	—
	Salsola sp.	count	seed	—	1	—	—	—	—	—
	Suaeda sp.	count	seed	1	5	—	—	1	—	—
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	endosperm	—	—	—	—	5	—	—
	Bolboschoenus glaucus	count	achene	—	—	—	—	—	—	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	1	23	—	—	2	—	2
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN15B860s15	KIN12B522s96	KIN12B562s158	KIN12B563s160	KIN13B617s26	KIN14B856s3	KIN12B540s130
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a-b	B.1a-b	B.1a-b	B.1b	B.1b	B.1b
			context type	surface	pit fill	pit fill	pit fill	layer	layer	pit fill
			soil volume (l)	10	10	10	1	10	6.5	10
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	1	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	1	—	—
	Trifolieae s.l.	count	seed	—	27	1	—	9	3	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	1	—	—	1	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	5	—	—	1	—	—
	Melilotus- type	count	seed	3	7	—	—	9	—	4
	Trifolium- type	count	seed	—	25	—	—	4	—	—
	Trigonella- type	count	seed	—	7	—	—	—	—	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	12	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	1	—
	Ziziphora sp.	count	nutlet	—	—	—	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	1	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	1	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	2	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	—	20	—	—	8	—	1
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	4	—	—	6	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	5	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	2	—	—	2	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	1	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	3	—	—	—	—	—

				KIN15B860s15	KIN12B522s96	KIN12B562s158	KIN12B563s160	KIN13B617s26	KIN14B856s3	KIN12B540s130
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a-b	B.1a-b	B.1a-b	B.1b	B.1b	B.1b
			context type	surface	pit fill	pit fill	pit fill	layer	layer	pit fill
			soil volume (l)	10	10	10	1	10	6.5	10
	Rumex sp.	count	achene	—	—	—	—	1	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	1	1	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	18	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	1
	Asperula arvensis /orientalis	count	fruit	—	24	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	—	12	—	—	1	—	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	1	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	2	—	—	—	1	—
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	2	5	—	—	—	—	1
	KH-unk1	count	—	—	—	—	—	—	—	37*
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	7	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	1	16	—	—	5	—	—
	Indeterminable fragments	weight	—	<0.001	0.022	<0.001	—	—	—	<0.001
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN15B860s15	KIN12B522s96	KIN12B562s158	KIN12B563s160	KIN13B617s26	KIN14B856s3	KIN12B540s130
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1a	B.1a-b	B.1a-b	B.1a-b	B.1b	B.1b	B.1b
			context type	surface	pit fill	pit fill	pit fill	layer	layer	pit fill
			soil volume (l)	10	10	10	1	10	6.5	10
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	0.394	1.98	0.342	0.229	3.181	1.195	0.958
	Wood charcoal >4mm	weight	wood	0.3	0.48	0.03	0.46	1.56	0.86	0.36
	Amorphous material	weight	unknwon	—	1.93	0.142	—	0.048	0.033	0.008
	Dung - sheep and goat pellet	weight	dung	—	0.374	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	1	—	—	—	—	—
unknown	Insect	count	insect	—	1	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	1	—	—	1	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	1	—	—	—	—	1
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	1	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	2	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN12B520s93	KIN16B502s13	KIN16B2169s11	KIN13B636s53	KIN13B789s155	KIN13B608s39	KIN13B633s45
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1b	B.1-2	B.1-2	B.2	B.2	B.2	B.2
			context type	surface	debris	layer	layer	layer	pit fill	pit fill
			soil volume (l)	10	6.2	16.25	9	15	10	7.5
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	—	P	P	P	P	P	P
	Cerealia	weight	caryopsis	—	<0.001	0.137	0.028	0.108	0.085	0.044
	Cerealia	count	germ	—	—	1	2	—	1	4
Barley	*Hordeum vulgare*	count	caryopsis	1	1	9	3	4	6	3
	Hordeum vulgare	weight	caryopsis	0.013	0.007	0.108	0.032	0.038	0.065	0.013
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	1	—	—
	Triticum sp.	weight	caryopsis	—	—	—	—	0.008	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	—	1	13	3	4	6	7
	Triticum aestivum /durum	weight	caryopsis	—	0.001	0.105	0.021	0.016	0.031	0.034
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	2	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	0.009	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	1	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	0.006	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	1	—	—	4
	Secale cereale	weight	caryopsis	—	—	—	<0.001	—	—	0.015
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	2
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	<0.001
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	1	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	<0.001	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	—	0.218	—	0.013	0.005	0.026
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	2	—	1	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	1	1	—	2	17
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	1	1	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	1	1	—	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	1	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	1
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	1.5	—	—	—	—
	Pulse indeterminable	weight	seed	—	—	<0.001	—	—	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	2	—	1	—	1
	Lens culinaris	weight	seed	—	—	0.011	—	0.011	—	0.009
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN12B520s93	KIN16B502s13	KIN16B2169s11	KIN13B636s53	KIN13B789s155	KIN13B608s39	KIN13B633s45
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1b	B.1-2	B.1-2	B.2	B.2	B.2	B.2
			context type	surface	debris	layer	layer	layer	pit fill	pit fill
			soil volume (l)	10	6.2	16.25	9	15	10	7.5
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	4	1	—	—	—
	Vicia ervilia	weight	seed	—	—	0.048	0.009	—	—	—
Vetch/field pea	*Vicia* /*Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /*Lathyrus*	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	1
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	<0.001
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus* /*Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /*Malus*	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	—	1	—	—	1	—
	Vitis vinifera	weight	seed	—	—	0.01	—	—	0.019	—
	Vitis vinifera	count	pedicel	—	—	—	—	—	—	1
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	1	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	1	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	2	—	4
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN12B520s93	KIN16B502s13	KIN16B2169s11	KIN13B636s53	KIN13B789s155	KIN13B608s39	KIN13B633s45
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1b	B.1-2	B.1-2	B.2	B.2	B.2	B.2
			context type	surface	debris	layer	layer	layer	pit fill	pit fill
			soil volume (l)	10	6.2	16.25	9	15	10	7.5
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	2	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	1	—	—	793**
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	1
	Onosma sp.	count	nutlet	—	—	—	—	—	—	7
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	—	1	—	—	7	5
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	1
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	13
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	1	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	1	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	6	—	—	2	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	3	2	—	—	22
	Atriplex sp.	count	bract	—	—	—	—	—	—	1
	Atriplex sp.	count	seed	—	—	—	—	—	—	6
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	1	1	5	—	5	134
	Salsola sp.	count	seed	1	—	5	—	15	—	—
	Suaeda sp.	count	seed	—	1	14	4	—	2	8
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	—	5	—	—	—	2
	Cyperaceae s.l.	count	endosperm	—	1	5	1	—	1	3
	Bolboschoenus glaucus	count	achene	—	1	—	—	—	—	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	1	—	2	—	1	2	4
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	2
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	1	—	—	2
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

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			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1b	B.1-2	B.1-2	B.2	B.2	B.2	B.2
			context type	surface	debris	layer	layer	layer	pit fill	pit fill
			soil volume (l)	10	6.2	16.25	9	15	10	7.5
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	1	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	1	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	2	2	4	55
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	4
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	—	3	—	—	—	—
	Melilotus- type	count	seed	—	1	10	1	—	—	50
	Trifolium- type	count	seed	—	—	2	—	—	—	28
	Trigonella- type	count	seed	—	—	1	—	—	—	163
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	1	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	3	—	—	1
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	2	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	1
	Ziziphora sp.	count	nutlet	—	—	—	—	—	—	1
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	1	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	1	—	8
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	1	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	1	—	—	1	2
Poaceae	Poaceae s.l.	count	caryopsis	—	—	4	4	1	2	34
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	—	—	25
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	2
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	2
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	1	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	7
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	1	—	—	1
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	1	—	—

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			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1b	B.1-2	B.1-2	B.2	B.2	B.2	B.2
			context type	surface	debris	layer	layer	layer	pit fill	pit fill
			soil volume (l)	10	6.2	16.25	9	15	10	7.5
	Rumex sp.	count	achene	—	—	1	—	1	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	1	—	—	—	—	—	4
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—	5
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	1	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	1	—	—	—	—	3	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	3	39
	Asperula sp.	count	fruit	—	—	—	1	—	—	—
	Galium sp.	count	fruit	—	—	6	1	1	—	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	3
	Veronica sp.	count	seed	—	—	—	1	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	7	—	—	—	—
	Hyoscyamus sp.	count	seed	—	—	10	2	1	—	3
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	–	—	—	5	1	3	—	5
	KH-unk1	count	–	—	—	329*	—	12	5	—
	KH-unk2	count	–	—	—	—	—	—	—	—
	KH-unk3	count	–	—	—	—	—	—	—	—
	KH-unk4	count	–	—	—	—	—	—	—	—
	KH-unk5	count	–	—	—	—	—	—	—	1
	KH-unk6	count	–	—	—	—	1	—	—	—
	KH-unk7	count	–	—	—	—	—	—	—	—
	KH-unk8	count	–	—	—	—	—	—	—	—
	KH-unk9	count	–	—	—	—	—	—	—	—
	KH-unk10	count	–	—	—	—	—	—	—	—
	KH-unk11	count	–	—	—	—	—	—	—	—
	Indeterminable	count	–	—	—	6	2	1	1	4
	Indeterminable fragments	weight	–	—	<0.001	<0.001	0.056	0.008	—	—
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	1
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN12B520s93	KIN16B502s13	KIN16B2169s11	KIN13B636s53	KIN13B789s155	KIN13B608s39	KIN13B633s45
			Trench	B	B	B	B	B	B	B
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I	KH-P I
			Phase	B.1b	B.1-2	B.1-2	B.2	B.2	B.2	B.2
			context type	surface	debris	layer	layer	layer	pit fill	pit fill
			soil volume (l)	10	6.2	16.25	9	15	10	7.5
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	0.417	0.361	4.191	1.05	2.67	1.128	1.282
	Wood charcoal >4mm	weight	wood	0.11	0.42	2.18	0.26	0.59	1.02	2.02
	Amorphous material	weight	unknwon	—	<0.001	0.053	0.155	0.061	0.031	6.429**
	Dung - sheep and goat pellet	weight	dung	—	—	—	0.006	—	—	0.037
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	2	—	—	—	0.025
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	1	—	1	626**
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	1	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	—	1	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	1	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	2	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	1
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	2	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	398	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN13B762s122	KIN15B2082s42	KIN14B895s78	KIN12B534s123	KIN13A146s61	KIN14A131s138	KIN18A1974s70
			Trench	B	B	B	B	A1	A1	A1
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P IIA	KH-P IIA	KH-P IIB
			Phase	B.2	B.2	B.2	B.2	A1.1a	A1.1a	A1.1
			context type	pit fill	pit fill	pithos fill	surface	surface	debris	layer
			soil volume (l)	14.5	26.5	10	10	10	9	20
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.075	0.178	0.077	0.044	<0.001	<0.001	0.021
	Cerealia	count	germ	—	1	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	5	6	5	2	1	1	—
	Hordeum vulgare	weight	caryopsis	0.057	0.037	0.025	0.01	0.023	<0.001	—
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	1	—	—	—
	Triticum sp.	weight	caryopsis	—	—	—	0.01	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	8	10	1	5	—	2	—
	Triticum aestivum /durum	weight	caryopsis	0.073	0.06	<0.001	0.029	—	0.012	—
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	1	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	0.007	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	1	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	0.006	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.015	—	0.022	—	—	—	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	2	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	—	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	1	4	—	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	1	—	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	1	1	—	—	—	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	2	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	1	1	0.5	3	1	—	—
	Pulse indeterminable	weight	seed	0.013	0.006	<0.001	0.024	0.007	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	—	—
	Lens culinaris	weight	seed	—	—	—	—	—	—	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN13B762s122	KIN15B2082s42	KIN14B895s78	KIN12B534s123	KIN13A146s61	KIN14A131s138	KIN18A1974s70
			Trench	B	B	B	B	A1	A1	A1
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P IIA	KH-P IIA	KH-P IIB
			Phase	B.2	B.2	B.2	B.2	A1.1a	A1.1a	A1.1
			context type	pit fill	pit fill	pithos fill	surface	surface	debris	layer
			soil volume (l)	14.5	26.5	10	10	10	9	20
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	2	4	—	—	1	—	—
	Vicia ervilia	weight	seed	0.02	0.042	—	—	0.005	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	P	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	0.006	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	2	2	1	—	92	—	—
	Vitis vinifera	weight	seed	0.022	0.031	0.005	—	1.073	—	—
	Vitis vinifera	count	pedicel	—	—	—	—	—	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	1	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN13B762s122	KIN15B2082s42	KIN14B895s78	KIN12B534s123	KIN13A146s61	KIN14A131s138	KIN18A1974s70
			Trench	B	B	B	B	A1	A1	A1
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P IIA	KH-P IIA	KH-P IIB
			Phase	B.2	B.2	B.2	B.2	A1.1a	A1.1a	A1.1
			context type	pit fill	pit fill	pithos fill	surface	surface	debris	layer
			soil volume (l)	14.5	26.5	10	10	10	9	20
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	1	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	1	—	1	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	1	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	2	—	—	—	—	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	1	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	7	—	—	—	—	2
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	3	—	—	1	—	1
	Salsola sp.	count	seed	—	—	—	3	—	—	—
	Suaeda sp.	count	seed	—	1	4	1	—	—	—
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	2	—	1	2	—	—	2
	Cyperaceae s.l.	count	endosperm	8	—	—	1	—	—	—
	Bolboschoenus glaucus	count	achene	5	—	—	—	—	—	1
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	48	—	—	—	—	—	1
	Carex spp. (trigonous)	count	achene	3	—	—	1	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	2	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN13B762s122	KIN15B2082s42	KIN14B895s78	KIN12B534s123	KIN13A146s61	KIN14A131s138	KIN18A1974s70
			Trench	B	B	B	B	A1	A1	A1
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P IIA	KH-P IIA	KH-P IIB
			Phase	B.2	B.2	B.2	B.2	A1.1a	A1.1a	A1.1
			context type	pit fill	pit fill	pithos fill	surface	surface	debris	layer
			soil volume (l)	14.5	26.5	10	10	10	9	20
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	1	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	2	2	2	—	2	—	2
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	—	—	—	—	—	—
	Melilotus- type	count	seed	4	—	—	—	—	—	—
	Trifolium- type	count	seed	2	—	—	—	—	—	—
	Trigonella- type	count	seed	—	—	—	—	2	—	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	1
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	1	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	1	3	1	—	2	—	—
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	1	—	—	—	1
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	1	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	1	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	4	—	—	—	1	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	1	—	—	—

				KIN13B762s122	KIN15B2082s42	KIN14B895s78	KIN12B534s123	KIN13A146s61	KIN14A131s138	KIN18A1974s70
			Trench	B	B	B	B	A1	A1	A1
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P IIA	KH-P IIA	KH-P IIB
			Phase	B.2	B.2	B.2	B.2	A1.1a	A1.1a	A1.1
			context type	pit fill	pit fill	pithos fill	surface	surface	debris	layer
			soil volume (l)	14.5	26.5	10	10	10	9	20
	Rumex sp.	count	achene	—	—	—	1	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	1	—	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	1	—	1	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	1	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	1	1	1	—	2	—	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	1	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	—	—	—	1	—	—
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	—	2	—	—	—	—	1
	KH-unk1	count	—	—	—	—	29*	—	—	—
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	17	12	6	—	2	—	2
	Indeterminable fragments	weight	—	0.005	0.018	<0.001	0.005	<0.001	<0.001	0.006
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	<0.001	—	—	—

				KIN13B762s122	KIN15B2082s42	KIN14B895s78	KIN12B534s123	KIN13A146s61	KIN14A131s138	KIN18A1974s70
			Trench	B	B	B	B	A1	A1	A1
			Period	KH-P I	KH-P I	KH-P I	KH-P I	KH-P IIA	KH-P IIA	KH-P IIB
			Phase	B.2	B.2	B.2	B.2	A1.1a	A1.1a	A1.1
			context type	pit fill	pit fill	pithos fill	surface	surface	debris	layer
			soil volume (l)	14.5	26.5	10	10	10	9	20
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	4.223	1.562	1.372	1.774	6.662	0	21.347
	Wood charcoal >4mm	weight	wood	0.77	0.63	0.04	1.65	2.88	0	12.45
	Amorphous material	weight	unknwon	1.535	0.037	0.05	—	0.014	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	1	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	1	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	10	—	—	—	—	—	5
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	1	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN18A1987s73	KIN17A1830s12	KIN14A1502s44	KIN14A1512s48	KIN15A1539s77	KIN15A1607s11	KIN14A1540s98
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1	A1.1	A1.1a-b	A1.1b	A1.1c	A1.1c	A1.1c
			context type	layer	pit fill	layer	pyro.	layer	layer	pyro.
			soil volume (l)	18	8	7.15	3.8	8.5	7.75	8.15
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	—	—	P	—
	Cerealia	weight	caryopsis	0.112	<0.001	0.007	—	—	0.011	—
	Cerealia	count	germ	—	—	—	1	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	P	1	1	1	1	—	P
	Hordeum vulgare	weight	caryopsis	0.005	0.011	<0.001	0.005	0.008	—	<0.001
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	—	—	—
	Triticum sp.	weight	caryopsis	—	—	—	—	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	3	1	—	2	—	1	1
	Triticum aestivum /durum	weight	caryopsis	0.016	<0.001	—	0.013	—	0.005	<0.001
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	1	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	0.005	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	—	<0.001	<0.001	0.299	—	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	—	2	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	1	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	—	2	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	1	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	1	—	—	—	4	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	2	—	—	—	—	—	—
	Pulse indeterminable	weight	seed	0.021	—	—	—	—	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	1	1	—	1	—
	Lens culinaris	weight	seed	—	—	0.005	0.005	—	0.005	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	1	—	—
	Pisum sativum	weight	seed	—	—	—	—	0.01	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN18A1987s73	KIN17A1830s12	KIN14A1502s44	KIN14A1512s48	KIN15A1539s77	KIN15A1607s11	KIN14A1540s98
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1	A1.1	A1.1a-b	A1.1b	A1.1c	A1.1c	A1.1c
			context type	layer	pit fill	layer	pyro.	layer	layer	pyro.
			soil volume (l)	18	8	7.15	3.8	8.5	7.75	8.15
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	1	—	—	—	1
	Vicia ervilia	weight	seed	—	—	0.012	—	—	—	0.07
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	P	P	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	0.014	0.033	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	P	—	—
	Juglans regia	weight	endocarp	—	—	—	—	0.02	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	2	1	2	12	60	1	1
	Vitis vinifera	weight	seed	0.017	0.017	0.035	0.149	0.38	0.007	0.015
	Vitis vinifera	count	pedicel	1	—	—	12	7	—	1
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	2	21	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	5	53	1	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	1	—	—	—	1	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	1	1	1	2	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	1	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	1
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN18A1987s73	KIN17A1830s12	KIN14A1502s44	KIN14A1512s48	KIN15A1539s77	KIN15A1607s11	KIN14A1540s98
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1	A1.1	A1.1a-b	A1.1b	A1.1c	A1.1c	A1.1c
			context type	layer	pit fill	layer	pyro.	layer	layer	pyro.
			soil volume (l)	18	8	7.15	3.8	8.5	7.75	8.15
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	1	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	3	—	—	—	3	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	—	—	3	—	—	14
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	1	33	—	83
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	1	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	1	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	6	13	6	9	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	1	12	8	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	2	29	—	4	9	—	2
	Salsola sp.	count	seed	2	15	2	—	1	—	—
	Suaeda sp.	count	seed	4	2	—	1	3	—	—
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	2	1	6	104	—	—	3
	Cyperaceae s.l.	count	endosperm	4	—	10	110	—	—	—
	Bolboschoenus glaucus	count	achene	—	—	—	—	1	—	—
	Bolboschoenus sp.	count	achene	1	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	17	12	37	14	12	—	2
	Carex spp. (trigonous)	count	achene	2	—	—	—	2	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	7	—	—	3	1	—	—
	Eleocharis sp.-type 2	count	achene	1	2	17	356	2	—	—
	Fimbristylis sp.	count	achene	2	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	3	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	3	3	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN18A1987s73	KIN17A1830s12	KIN14A1502s44	KIN14A1512s48	KIN15A1539s77	KIN15A1607s11	KIN14A1540s98
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1	A1.1	A1.1a-b	A1.1b	A1.1c	A1.1c	A1.1c
			context type	layer	pit fill	layer	pyro.	layer	layer	pyro.
			soil volume (l)	18	8	7.15	3.8	8.5	7.75	8.15
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	2	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	2	8	9	3	4	—	3
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	2	—	—	—	—	—
	Medicago- type	count	seed	—	3	20	2	3	—	—
	Melilotus- type	count	seed	9	—	10	3	9	—	—
	Trifolium- type	count	seed	5	—	4	8	3	—	—
	Trigonella- type	count	seed	5	—	5	2	—	—	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	2	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	1	—	1	1	1	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	1	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	5	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	6	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	1	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	29
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	1	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	18	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	5	3	75	555	20	—	—
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	1	4	—	6	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	2	134	1	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	9	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	4	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	3	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	1	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	7	6	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	1	—	3	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	2	4	—	1	—	—	1

				KIN18A1987s73	KIN17A1830s12	KIN14A1502s44	KIN14A1512s48	KIN15A1539s77	KIN15A1607s11	KIN14A1540s98
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1	A1.1	A1.1a-b	A1.1b	A1.1c	A1.1c	A1.1c
			context type	layer	pit fill	layer	pyro.	layer	layer	pyro.
			soil volume (l)	18	8	7.15	3.8	8.5	7.75	8.15
	Rumex sp.	count	achene	—	—	25	34	—	—	1
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	1	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	3	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—	3
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	325	1801	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	3	1	—	1	1	1	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	1
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	3	—	1	10	—	—
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	1	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	1	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	1	1	5	15	1	—	2
	KH-unk1	count	—	—	—	—	—	—	—	—
	KH-unk2	count	—	—	1	—	—	—	—	—
	KH-unk3	count	—	1	8	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	8	1	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	—	2	—	—	8	—	—
	Indeterminable fragments	weight	—	0.018	0.007	0.009	0.026	0.031	<0.001	<0.001
	Indeterminable nut fragments	weight	endocarp	—	—	—	0.035	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	2	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	0.007	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	24	—	—
	Thorn	count	thorn	—	1	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	1	—
	Unknown plant part (uncountable)	weight	unknown	—	0.012	—	—	—	—	0.009

				KIN18A1987s73	KIN17A1830s12	KIN14A1502s44	KIN14A1512s48	KIN15A1539s77	KIN15A1607s11	KIN14A1540s98
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1	A1.1	A1.1a-b	A1.1b	A1.1c	A1.1c	A1.1c
			context type	layer	pit fill	layer	pyro.	layer	layer	pyro.
			soil volume (l)	18	8	7.15	3.8	8.5	7.75	8.15
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	27.629	0.275	1.359	2.396	4.964	28.011	38.293
	Wood charcoal >4mm	weight	wood	23.46	0.13	0.57	0.27	6.79	19.21	56.31
	Amorphous material	weight	unknwon	0.031	—	0.053	0.161	2.14	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	1	—	—
	Larvae	count	insect	—	—	—	—	2	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	24	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	2	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	1	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	4	—	—	73	172	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN14A1534s101	KIN13A967s266	KIN12A233s261	KIN12A233s273	KIN12A237s238	KIN13A939s257	KIN13A950s242
			Trench	A1	A2	A2	A2	A2	A2	A2
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1c	A2.2	A2.2	A2.2	A2.2	A2.2	A2.2
			context type	surface	layer	pit fill	pit fill	pit fill	pit fill	pit fill
			soil volume (l)	10.45	11	2	8	3	13	14
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.068	0.113	0.013	0.104	0.19	0.72	0.336
	Cerealia	count	germ	—	—	—	—	—	1	—
Barley	*Hordeum vulgare*	count	caryopsis	8	2	2	12	9	19	8
	Hordeum vulgare	weight	caryopsis	0.211	0.02	0.013	0.111	0.121	0.172	0.133
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	P	—	—	2	—	—	—
	Triticum sp.	weight	caryopsis	0.009	—	—	0.011	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	3	14	3	6	12	165	27
	Triticum aestivum /durum	weight	caryopsis	0.029	0.112	0.022	0.037	0.112	1.02	0.292
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	1	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	<0.001	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	0.007	0.008	<0.001	0.033	0.598	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	—	—	—	2
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	1	4	—	—	26	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	—	5	210	6
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	13	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	2	—	6	85	—
	Triticum aestivum	count	rachis segment	—	—	—	—	1	4	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	1	6	1	1	1.5	—	2.5
	Pulse indeterminable	weight	seed	0.008	0.052	0.045	0.036	0.017	—	0.026
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	2	1	1	6	—	—	2
	Lens culinaris	weight	seed	0.017	0.005	0.005	0.065	—	—	0.022
Common pea	*Pisum sativum*	count	seed	—	—	—	—	1	—	—
	Pisum sativum	weight	seed	—	—	—	—	0.032	—	—
Broad bean	*Vicia faba*	count	seed	—	2	—	—	—	—	—

				KIN14A1534s101	KIN13A967s266	KIN12A233s261	KIN12A233s273	KIN12A237s238	KIN13A939s257	KIN13A950s242
			Trench	A1	A2	A2	A2	A2	A2	A2
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1c	A2.2	A2.2	A2.2	A2.2	A2.2	A2.2
			context type	surface	layer	pit fill	pit fill	pit fill	pit fill	pit fill
			soil volume (l)	10.45	11	2	8	3	13	14
	Vicia faba	weight	seed	—	0.029	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	10	2	—	—	2	4
	Vicia ervilia	weight	seed	—	0.093	0.027	—	—	0.019	0.027
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	4	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	0.037	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	1	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	<0.001	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	11	27	P	1	P	—	1
	Vitis vinifera	weight	seed	0.084	0.058	<0.001	<0.001	0.005	—	0.009
	Vitis vinifera	count	pedicel	—	14	1	—	2	1	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	1	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	2	1	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	1	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	2	1	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN14A1534s101	KIN13A967s266	KIN12A233s261	KIN12A233s273	KIN12A237s238	KIN13A939s257	KIN13A950s242
			Trench	A1	A2	A2	A2	A2	A2	A2
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1c	A2.2	A2.2	A2.2	A2.2	A2.2	A2.2
			context type	surface	layer	pit fill	pit fill	pit fill	pit fill	pit fill
			soil volume (l)	10.45	11	2	8	3	13	14
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	1	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	3	—	1	1
	Echium sp.	count	nutlet	2	—	—	41	—	1	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	1	—	—	—	—	—	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	1	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	1	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	1	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	1	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	1	—	1	—	2	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	1	—	—	—	2	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	1	1	—	—	—
	Salsola sp.	count	seed	—	—	—	—	—	1	—
	Suaeda sp.	count	seed	2	—	—	—	2	1	1
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	2	3	—	—	1	—	—
	Cyperaceae s.l.	count	endosperm	2	—	—	—	—	—	—
	Bolboschoenus glaucus	count	achene	1	2	—	1	—	—	—
	Bolboschoenus sp.	count	achene	1	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	12	7	3	5	—	3	6
	Carex spp. (trigonous)	count	achene	6	31	—	—	—	—	—
	Cyperus sp.	count	achene	1	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	1	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	2
	Cyperaceae/Polygonaceae	count	endosperm	—	1	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN14A1534s101	KIN13A967s266	KIN12A233s261	KIN12A233s273	KIN12A237s238	KIN13A939s257	KIN13A950s242
			Trench	A1	A2	A2	A2	A2	A2	A2
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1c	A2.2	A2.2	A2.2	A2.2	A2.2	A2.2
			context type	surface	layer	pit fill	pit fill	pit fill	pit fill	pit fill
			soil volume (l)	10.45	11	2	8	3	13	14
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	2	—
	Trifolieae s.l.	count	seed	9	8	—	5	5	5	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	4	4	—	4	2	4	—
	Melilotus- type	count	seed	2	48	—	4	1	—	—
	Trifolium- type	count	seed	—	33	—	5	—	—	—
	Trigonella- type	count	seed	—	—	—	—	2	—	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	1	—	—	—	1	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	1	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	3	—
	Bellevalia sp.	count	seed	—	1	—	1	—	—	1
	Ornithogalum sp.	count	seed	—	—	—	—	—	1	—
Malvaceae	*Malva* sp.	count	seed	—	1	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	1	—	—	1	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	1	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	29	5	6	—	8	4	3
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	3	1
	Poaceae s.l.	count	glume	—	—	—	—	—	2	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	1	—
	Bromus sp.	count	caryopsis	1	—	—	—	—	1	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	1	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	1
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	1	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	1	2	—	2	—	6	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	3	—	—	—	—	—

				KIN14A1534s101	KIN13A967s266	KIN12A233s261	KIN12A233s273	KIN12A237s238	KIN13A939s257	KIN13A950s242
			Trench	A1	A2	A2	A2	A2	A2	A2
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1c	A2.2	A2.2	A2.2	A2.2	A2.2	A2.2
			context type	surface	layer	pit fill	pit fill	pit fill	pit fill	pit fill
			soil volume (l)	10.45	11	2	8	3	13	14
	Rumex sp.	count	achene	2	—	—	—	1	1	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	1	—	1	1	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	1	—	1	—	1	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	—	11	3	1	6	7	2
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	3	1	—	1	—	4	1
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	3	1	1	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	—	1	1	—	3	3	—
	KH-unk1	count	—	—	—	—	—	4	—	—
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	1
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	6	—	—	3	—	—	—
	Indeterminable fragments	weight	—	0.018	0.072	0.011	<0.001	0.036	0.015	0.008
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	2	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	1	—	—	—	—	1
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN14A1534s101	KIN13A967s266	KIN12A233s261	KIN12A233s273	KIN12A237s238	KIN13A939s257	KIN13A950s242
			Trench	A1	A2	A2	A2	A2	A2	A2
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A1.1c	A2.2	A2.2	A2.2	A2.2	A2.2	A2.2
			context type	surface	layer	pit fill	pit fill	pit fill	pit fill	pit fill
			soil volume (l)	10.45	11	2	8	3	13	14
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	7.905	8.591	0.418	0.374	nr	0.482	1.173
	Wood charcoal >4mm	weight	wood	1.57	5.29	0.02	0.05	1.27	0.19	0.34
	Amorphous material	weight	unknwon	0.23	0.16	0.038	<0.001	0.004	—	0.025
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	0.005	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	4	1	—	—	2	—	—
	Echium sp.	count	nutlet	—	—	—	145	1	—	1
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	3	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	1	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	1	—	—	—
	Cyperaceae s.l.	count	achene	554	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN13A972s304	KIN13A982s293	KIN14B803s113	KIN12B560s156	KIN15B2109s93	KIN16B2221s116	KIN15B2113s108
			Trench	A2	A2	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A2.2	A2.2	B.3a	B.3b/4a	B.3b/4a	B.3b/4a	B.4
			context type	pit fill	pit fill	surface	layer	layer	surface	pyro.
			soil volume (l)	19	16	0.1	10	16	16.5	6
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	2	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.164	0.185	0.007	<0.001	<0.001	1.405	0.114
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	19	14	1	4	—	47	8
	Hordeum vulgare	weight	caryopsis	0.199	0.125	<0.001	0.027	—	1.149	0.091
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	—	5	—
	Triticum sp.	weight	caryopsis	—	—	—	—	—	0.06	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	28	35	1	2	1	108	5
	Triticum aestivum /durum	weight	caryopsis	0.258	0.22	0.019	0.016	0.011	1.116	0.04
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	P	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	<0.001	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	1	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	0.01	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	1	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	<0.001	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.096	0.022	<0.001	—	—	0.423	0.03
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	3	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	6	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	—	—	8	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	2	4	—	—	—	67	11
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	2
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	6	12	—	—	—	118	10
	Triticum aestivum/durum	count	rachis segment frg	—	1	1	—	—	42	2
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	1	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	76	2
Bread wheat	Triticum aestivum	count	rachis segment frg	7	8	—	—	—	124	6
	Triticum aestivum	count	rachis segment	1	—	—	—	—	13	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	3	—	—	—	4	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	1	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	1	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	1	—	0.5	—	P	P
	Pulse indeterminable	weight	seed	—	0.013	—	<0.001	—	0.009	0.006
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	1	1	—	—	—	—	—
	Lens culinaris	weight	seed	0.005	0.012	—	—	—	—	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	1	—
	Pisum sativum	weight	seed	—	—	—	—	—	0.035	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN13A972s304	KIN13A982s293	KIN14B803s113	KIN12B560s156	KIN15B2109s93	KIN16B2221s116	KIN15B2113s108
			Trench	A2	A2	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A2.2	A2.2	B.3a	B.3b/4a	B.3b/4a	B.3b/4a	B.4
			context type	pit fill	pit fill	surface	layer	layer	surface	pyro.
			soil volume (l)	19	16	0.1	10	16	16.5	6
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	1.5	1	—	—	—	2.5	12
	Vicia ervilia	weight	seed	0.019	0.005	—	—	—	0.043	0.111
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	2
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	0.019
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	1	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	0.017	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	P	—
	Prunus sp.	weight	seed	—	—	—	—	—	0.029	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	1	—
	Rubus sp.	weight	seed	—	—	—	—	—	<0.001	—
Grape	*Vitis vinifera*	count	seed	—	—	—	—	51	2	1
	Vitis vinifera	weight	seed	—	—	—	—	0.447	0.031	0.009
	Vitis vinifera	count	pedicel	—	—	—	—	—	3	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	1	—
	Linum sp.	weight	seed	—	—	—	—	—	<0.001	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	5	2
	Apium -type	count	schizocarp	—	—	—	—	—	3	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	1	—	7	1
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	1
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	2
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	1	1	—	—	—	4	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN13A972s304	KIN13A982s293	KIN14B803s113	KIN12B560s156	KIN15B2109s93	KIN16B2221s116	KIN15B2113s108
			Trench	A2	A2	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A2.2	A2.2	B.3a	B.3b/4a	B.3b/4a	B.3b/4a	B.4
			context type	pit fill	pit fill	surface	layer	layer	surface	pyro.
			soil volume (l)	19	16	0.1	10	16	16.5	6
	Crepis- type	count	achene	—	—	—	—	—	1	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	2	4	—	—	—	12	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	3	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	—	—	2	—	9	4
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	1	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	11	1
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	3	—
	Euclidum syriacum	count	silicle	—	1	—	—	—	9	—
	Lepidium sp.	count	seed	—	—	—	—	—	1	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	1	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	4	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	21	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	2	2	1	1	—	42	1
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	53	1
	Beta sp.	count	seed	—	—	—	—	—	2	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	2	43	—
	Salsola sp.	count	seed	—	4	—	—	2	29	—
	Suaeda sp.	count	seed	1	1	1	—	—	16	2
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	2	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	1	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	—	—	1	—	2	1
	Cyperaceae s.l.	count	endosperm	2	4	—	—	—	3	—
	Bolboschoenus glaucus	count	achene	—	—	—	—	—	1	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	5	4	—	—	1	21	2
	Carex spp. (trigonous)	count	achene	—	—	—	1	1	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	1	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN13A972s304	KIN13A982s293	KIN14B803s113	KIN12B560s156	KIN15B2109s93	KIN16B2221s116	KIN15B2113s108
			Trench	A2	A2	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A2.2	A2.2	B.3a	B.3b/4a	B.3b/4a	B.3b/4a	B.4
			context type	pit fill	pit fill	surface	layer	layer	surface	pyro.
			soil volume (l)	19	16	0.1	10	16	16.5	6
	Cephalaria -type	count	achene	—	—	—	—	—	2	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	1	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	2	9	—	—	—	20	6
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	1	—	—	—	6	1
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	1	13	—	—	—	20	—
	Melilotus- type	count	seed	6	2	—	—	—	70	—
	Trifolium- type	count	seed	2	—	—	—	—	9	2
	Trigonella- type	count	seed	—	—	—	—	—	64	1
	Coronilla-type	count	seed	—	—	—	—	—	1	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	1	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	1	—
	Ajuga- type	count	nutlet	—	—	—	—	—	10	1
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	1	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	1	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	—	—	1	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	1	—
	Allium -type	count	bulbile	—	—	—	—	—	1	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	1	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	5	—
	Papaver sp.	count	seed	—	—	—	—	—	6	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	1
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	3	1
Poaceae	Poaceae s.l.	count	caryopsis	1	1	1	1	—	33	6
	Poaceae s.l.	count	rachis internode	—	1	—	—	—	2	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	1	—	—	—	3	—
	Bromus sp.	count	caryopsis	1	—	—	—	—	5	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	1	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	1	—	—	—	—	2	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	1
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	1
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	3	1
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	4	—	—	—	11	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	2	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	5	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	—	4	—

				KIN13A972s304	KIN13A982s293	KIN14B803s113	KIN12B560s156	KIN15B2109s93	KIN16B2221s116	KIN15B2113s108
			Trench	A2	A2	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A2.2	A2.2	B.3a	B.3b/4a	B.3b/4a	B.3b/4a	B.4
			context type	pit fill	pit fill	surface	layer	layer	surface	pyro.
			soil volume (l)	19	16	0.1	10	16	16.5	6
	Rumex sp.	count	achene	—	—	—	—	1	9	2
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	2	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	1	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	7	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	1	—	3	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	1	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	1	—
	Galium sp.	count	fruit	2	—	—	—	1	25	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	2	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	1	—
	Hyoscyamus sp.	count	seed	—	2	—	1	1	9	1
	Solanum sp.	count	seed	—	—	—	—	—	4	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	1	—	—	—	—	8	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	2	—	—	—	—	11	4
	KH-unk1	count	—	—	—	—	2	—	—	12
	KH-unk2	count	—	—	—	—	—	—	5	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	1	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	2	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	—	1	—	—	—	24	7
	Indeterminable fragments	weight	—	—	<0.001	<0.001	—	<0.001	0.583	<0.001
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	1	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN13A972s304	KIN13A982s293	KIN14B803s113	KIN12B560s156	KIN15B2109s93	KIN16B2221s116	KIN15B2113s108
			Trench	A2	A2	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	A2.2	A2.2	B.3a	B.3b/4a	B.3b/4a	B.3b/4a	B.4
			context type	pit fill	pit fill	surface	layer	layer	surface	pyro.
			soil volume (l)	19	16	0.1	10	16	16.5	6
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	1.187	1.265	0.008	2.755	10.441	3.773	0.441
	Wood charcoal >4mm	weight	wood	0.31	0.59	0.43	1.17	10.15	1.4	0.93
	Amorphous material	weight	unknwon	—	0.019	—	—	0.01	0.157	0.007
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	0.028	—	—	—	—	—	—
	Dung	weight	dung	—	0.061	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	#REF!	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	1
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	4	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	1	—	—	1	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	2	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN15B2111s116	KIN12B549s138	KIN16B2181s34	KIN16B2196s59	KIN15B2107s86	KIN14B2031s133	KIN15B2098s77
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4a	B.4a/b	B.4b	B.4b/c	B.4c	B.4c	B.4c
			context type	layer	surface	layer	dump	layer	pithos fill	pithos fill
			soil volume (l)	3	nr	7.25	17	10	27	20.25
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.007	0.065	0.023	0.041	0.059	0.603	0.045
	Cerealia	count	germ	—	—	—	—	—	—	1
Barley	*Hordeum vulgare*	count	caryopsis	1	6	4	4	4	5	1
	Hordeum vulgare	weight	caryopsis	0.008	0.07	0.023	0.038	0.051	0.063	0.008
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	1	—	1	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	0.008	—	0.009	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	P	2	—	5	—
	Triticum sp.	weight	caryopsis	—	—	0.015	0.012	—	0.034	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	—	18	—	7	P	70	5
	Triticum aestivum /durum	weight	caryopsis	—	0.096	—	0.077	0.016	0.578	0.052
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	1	1	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	0.009	0.02	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	36	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	0.151	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	4	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	0.034	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	9	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	<0.001	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	1	2	—
	Setaria italica	weight	caryopsis	—	—	—	—	<0.001	<0.001	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	0.098	—	0.069	—	0.127	0.005
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	—	—	—	1
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	1	3	1	15	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	2	—	1	1	—	2
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	4	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	1	4	—	7	—	18	3
	Triticum aestivum	count	rachis segment	—	—	—	2	—	—	1
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	1	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	7	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	—	—	2	0.5	—
	Pulse indeterminable	weight	seed	—	—	—	—	0.079	0.026	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	0.5	—
	Lens culinaris	weight	seed	—	—	—	—	—	<0.001	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	3	—	—
	Pisum sativum	weight	seed	—	—	—	—	0.066	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN15B2111s116	KIN12B549s138	KIN16B2181s34	KIN16B2196s59	KIN15B2107s86	KIN14B2031s133	KIN15B2098s77
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4a	B.4a/b	B.4b	B.4b/c	B.4c	B.4c	B.4c
			context type	layer	surface	layer	dump	layer	pithos fill	pithos fill
			soil volume (l)	3	nr	7.25	17	10	27	20.25
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	1.5	—	1	—	—	1
	Vicia ervilia	weight	seed	—	0.01	—	0.007	—	—	0.008
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	9	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	0.115	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	2	—
	Ficus carica	weight	seed	—	—	—	—	—	<0.001	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	1	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	0.001	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	P	1	1	—	—	5	—
	Vitis vinifera	weight	seed	0.007	0.009	<0.001	—	—	0.044	—
	Vitis vinifera	count	pedicel	—	1	—	—	—	90	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	3	—
	Vitis vinifera	count	tendril	5	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	1	2	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	1	—	1	—	1
	Asteraceae s.l.	count	capitulum	—	1	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	1
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	1	1	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

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			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4a	B.4a/b	B.4b	B.4b/c	B.4c	B.4c	B.4c
			context type	layer	surface	layer	dump	layer	pithos fill	pithos fill
			soil volume (l)	3	nr	7.25	17	10	27	20.25
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	1	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	1	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	1	2	3	1	2	1
	Echium sp.	count	nutlet	—	—	6	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	7	—	—	—
	Onosma sp.	count	nutlet	—	—	1	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	1	—	3	1	3	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	1	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	1	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	1	—	—
	Vaccaria pyramidata	count	seed	—	5	3	1	—	1	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	1	—	5	1
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	1	1	—	4	1	15	2
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	9	—
	Chenopodium sp.	count	seed	1	—	—	1	4	120	—
	Salsola sp.	count	seed	—	10	142	—	—	4	—
	Suaeda sp.	count	seed	7	2	5	8	3	37	2
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	1	—	2	2	3	—
	Cyperaceae s.l.	count	endosperm	—	—	2	3	1	—	3
	Bolboschoenus glaucus	count	achene	—	2	1	—	1	1	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	1
	Carex spp. (flattened)	count	achene	1	6	10	12	5	1	1
	Carex spp. (trigonous)	count	achene	—	2	1	—	—	1	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	1	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

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			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4a	B.4a/b	B.4b	B.4b/c	B.4c	B.4c	B.4c
			context type	layer	surface	layer	dump	layer	pithos fill	pithos fill
			soil volume (l)	3	nr	7.25	17	10	27	20.25
	Cephalaria -type	count	achene	—	—	1	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	1	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	1	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	1	3	9	—	1	4
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	2	—	1	—	4	—
	Melilotus- type	count	seed	—	3	—	6	1	14	—
	Trifolium- type	count	seed	—	1	—	5	1	7	—
	Trigonella- type	count	seed	—	—	—	—	1	5	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	1	1	3	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	1	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	1	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	7	—	—	—
	Papaver sp.	count	seed	—	—	—	2	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	1	1	1	2	5	16	1
	Poaceae s.l.	count	rachis internode	—	1	—	—	—	1	1
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	—	2	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	1	—	1
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	1	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	1	—	1	—	1	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	1	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	1	1	—	—

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			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4a	B.4a/b	B.4b	B.4b/c	B.4c	B.4c	B.4c
			context type	layer	surface	layer	dump	layer	pithos fill	pithos fill
			soil volume (l)	3	nr	7.25	17	10	27	20.25
	Rumex sp.	count	achene	1	1	—	1	1	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	1	1	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	1	—	—	1	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	6	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	2	3	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	1	3	—	2	—	3	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	1	1	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	1	—	—
	Veronica triphyllos	count	seed	—	—	—	1	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	3	—	—	—
	Hyoscyamus sp.	count	seed	—	—	2	8	—	3	—
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	—	—	3	3	—	7	1
	KH-unk1	count	—	—	38*	597*	293*	3	14	67
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	1	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	1	2	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	—	—	—	2	7	—	2
	Indeterminable fragments	weight	—	<0.001	0.017	—	0.027	0.02	0.087	0.008
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	3	—	—	—	2	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	1	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	3	85	—	—	—
	Thorn	count	thorn	—	4	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	1	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	0.026	—	—	—	—

				KIN15B2111s116	KIN12B549s138	KIN16B2181s34	KIN16B2196s59	KIN15B2107s86	KIN14B2031s133	KIN15B2098s77
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4a	B.4a/b	B.4b	B.4b/c	B.4c	B.4c	B.4c
			context type	layer	surface	layer	dump	layer	pithos fill	pithos fill
			soil volume (l)	3	nr	7.25	17	10	27	20.25
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	4.563	7.27	2.061	4.003	0.83	2.338	1.086
	Wood charcoal >4mm	weight	wood	1.38	5.5	0.63	3.6	0.04	1.52	0.15
	Amorphous material	weight	unknwon	—	0.412	1.47	0.309	0.034	0.815	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	0.05	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	1	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	2	5	—	—	—	1
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	1	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	—	5	4	21	—	6	—
	Fimbristylis sp.	count	achene	—	1	1	3	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	1	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	1	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	9

				KIN13B767s126	KIN14B2032s135a	KIN14B2032s135b	KIN14B2032s140	KIN14B845s132	KIN15B2091s57	KIN14B2018s120
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c
			context type	pyro.	pyro.	pyro.	pyro.	pyro.	pyro.	surface
			soil volume (l)	20	4.5	4	4.5	3.15	3	nr
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	1	P	P	P	P	P
	Cerealia	weight	caryopsis	0.221	0.06	<0.001	0.024	0.038	0.045	0.029
	Cerealia	count	germ	1	—	—	—	—	—	1
Barley	*Hordeum vulgare*	count	caryopsis	10	6	1	1	P	3	3
	Hordeum vulgare	weight	caryopsis	0.09	0.051	0.007	<0.001	0.05	0.02	0.03
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	1	P	P	2	1	—	—
	Triticum sp.	weight	caryopsis	0.005	<0.001	<0.001	0.007	0.006	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	11	5	2	10	8	—	—
	Triticum aestivum /durum	weight	caryopsis	0.082	0.024	0.011	0.057	0.062	—	—
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	P	P	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	<0.001	<0.001	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	1	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	0.006	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	1	—	—	—	1	—	—
	Panicum miliaceum	weight	caryopsis	<0.001	—	—	—	<0.001	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	<0.001	0.016	0.103	0.007	0.015	—	—
Cereals undif.	Cerealia	count	rachis segment frg	1	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	1	3	—	—	1	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	10	—	—	5	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	6	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	2	—	—	1	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	2	—	—	—	3	1	—
	Triticum aestivum	count	rachis segment	1	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	—	—	P	—	—
	Pulse indeterminable	weight	seed	—	—	—	—	0.016	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	1	—
	Lens culinaris	weight	seed	—	—	—	—	—	0.006	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	16	—
	Pisum sativum	weight	seed	—	—	—	—	—	0.371	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN13B767s126	KIN14B2032s135a	KIN14B2032s135b	KIN14B2032s140	KIN14B845s132	KIN15B2091s57	KIN14B2018s120
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c
			context type	pyro.	pyro.	pyro.	pyro.	pyro.	pyro.	surface
			soil volume (l)	20	4.5	4	4.5	3.15	3	nr
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	—	—	—	—	—
	Vicia ervilia	weight	seed	—	—	—	—	—	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	3	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	0.031	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	1	—	—
	Ficus carica	weight	seed	—	—	—	—	<0.001	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	P
	Juglans regia	weight	endocarp	—	—	—	—	—	—	<0.001
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	6	—	1	—	—	—	1
	Vitis vinifera	weight	seed	0.028	—	<0.001	—	—	—	0.013
	Vitis vinifera	count	pedicel	1	—	—	—	5	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	22	—	—	—	1	—	—
	Apium -type	count	schizocarp	1	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	1	3	8	—	—	—	1
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	1	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	1	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	6	—	—	—	—
	Centaurea sp.	count	achene	—	2	1	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN13B767s126	KIN14B2032s135a	KIN14B2032s135b	KIN14B2032s140	KIN14B845s132	KIN15B2091s57	KIN14B2018s120
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c
			context type	pyro.	pyro.	pyro.	pyro.	pyro.	pyro.	surface
			soil volume (l)	20	4.5	4	4.5	3.15	3	nr
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	1	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	6	—	—	—	2	—	1
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	16	7	2	—	2	3	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	1	—	—	10	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	8	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	1	—
	Lepidium sp.	count	seed	—	2	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	1	—	—	—
	Vaccaria pyramidata	count	seed	—	1	—	—	1	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	1	15	16	—	5	1	—
	Atriplex sp.	count	bract	—	7	4	—	—	—	—
	Atriplex sp.	count	seed	3	309	24	—	2	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	4	6	—	6	—	—
	Salsola sp.	count	seed	1	1	—	—	1	—	—
	Suaeda sp.	count	seed	1	2	—	1	10	—	1
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	—	—	—	2	—	1
	Cyperaceae s.l.	count	endosperm	—	—	—	—	1	—	—
	Bolboschoenus glaucus	count	achene	2	1	—	—	1	—	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	6	11	—	—	1	4	1
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	1
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	1	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	1	—	—	—	—	—	1
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	2	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN13B767s126	KIN14B2032s135a	KIN14B2032s135b	KIN14B2032s140	KIN14B845s132	KIN15B2091s57	KIN14B2018s120
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c
			context type	pyro.	pyro.	pyro.	pyro.	pyro.	pyro.	surface
			soil volume (l)	20	4.5	4	4.5	3.15	3	nr
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	2	11	5	1	2	—	6
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	5	—	—	1	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	2	—	—	—	—	—
	Melilotus- type	count	seed	9	—	—	—	5	3	—
	Trifolium- type	count	seed	—	10	—	—	1	—	—
	Trigonella- type	count	seed	—	1	1	—	—	—	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	1	—	—	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	1	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	1	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	1	4	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	7	7	3	—	7	7	31
	Poaceae s.l.	count	rachis internode	—	—	—	—	4	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	1	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	3	—	—	—	1	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	1	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	3	1	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	1	5	2	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	1	—	—	—	—	—	—

				KIN13B767s126	KIN14B2032s135a	KIN14B2032s135b	KIN14B2032s140	KIN14B845s132	KIN15B2091s57	KIN14B2018s120
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c
			context type	pyro.	pyro.	pyro.	pyro.	pyro.	pyro.	surface
			soil volume (l)	20	4.5	4	4.5	3.15	3	nr
	Rumex sp.	count	achene	—	1	—	—	—	—	1
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	1	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	2	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	3	—	—	2	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	3	3	—	—	3	1	1
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	1	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	1	—	—
	Hyoscyamus sp.	count	seed	5	4	—	—	1	—	11
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	1	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	2	—	4	—	7	—	—
	KH-unk1	count	—	15	—	—	—	—	7	—
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	1	2	—	—	—	—
	KH-unk5	count	—	—	1	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	11	—	2	—	19	—	—
	Indeterminable fragments	weight	—	<0.001	0.046	0.005	<0.001	0.012	0.021	0.016
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	1	—	—	—	—	—	—
	Calyx	count	calyx	—	—	8	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	1	—
	Unknown plant part (uncountable)	weight	unknown	—	—	0.012	<0.001	—	—	—

				KIN13B767s126	KIN14B2032s135a	KIN14B2032s135b	KIN14B2032s140	KIN14B845s132	KIN15B2091s57	KIN14B2018s120
			Trench	B	B	B	B	B	B	B
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB	KH-P IIB
			Phase	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c	B.4c
			context type	pyro.	pyro.	pyro.	pyro.	pyro.	pyro.	surface
			soil volume (l)	20	4.5	4	4.5	3.15	3	nr
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	1.526	7.036	0.792	0.6	0.955	0.787	7.467
	Wood charcoal >4mm	weight	wood	1.35	20.87	0.82	1.042	0.84	0.87	9.65
	Amorphous material	weight	unknwon	0.017	16.378	0.632	0.022	0.083	0.067	0.385
	Dung - sheep and goat pellet	weight	dung	—	0.044	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	1	—	—	—	—	—
unknown	Insect	count	insect	—	3	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	1	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	1	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	1	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	4	—	—	—	1	—	—
	Fimbristylis sp.	count	achene	3	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	1	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	1	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	–	—	—	—	—	—	—	—

				KIN13D1041s23	KIN13D1044s25	KIN13D1070s71	KIN18A1902s4	KIN16A1683s4	KIN16A1689s26	KIN16A1685s52
			Trench	D	D	D	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D.2a/b	D.2a	D.2a	A1.2b	A1.2a	A1.2a	A1.2a
			context type	pit fill	pit fill	pyro.	layer	layer	layer	layer
			soil volume (l)	3	0.9	12	18	20.75	17	18
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.038	0.017	0.01	0.12	0.083	0.042	0.041
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	—	P	P	11	2	—	3
	Hordeum vulgare	weight	caryopsis	—	0.006	<0.001	0.126	0.023	—	0.026
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	1	—	—	—
	Triticum sp.	weight	caryopsis	—	—	—	0.05	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	4	—	1	20	1	3	—
	Triticum aestivum /durum	weight	caryopsis	0.01	—	0.005	0.151	<0.001	0.031	—
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	2	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	0.012	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	1	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	<0.001	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.02	—	—	0.013	0.012	—	0.007
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	1	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	8	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	3	—	—	—
	Triticum aestivum/durum	count	rachis segment frg	1	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	1	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	—	6	1	—	—
	Triticum aestivum	count	rachis segment	—	—	—	1	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	1	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	0.5	—	P	1	—	—	—
	Pulse indeterminable	weight	seed	0.015	—	0.022	0.005	—	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	7	—	—	1
	Lens culinaris	weight	seed	—	—	—	0.033	—	—	0.006
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN13D1041s23	KIN13D1044s25	KIN13D1070s71	KIN18A1902s4	KIN16A1683s4	KIN16A1689s26	KIN16A1685s52
			Trench	D	D	D	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D.2a/b	D.2a	D.2a	A1.2b	A1.2a	A1.2a	A1.2a
			context type	pit fill	pit fill	pyro.	layer	layer	layer	layer
			soil volume (l)	3	0.9	12	18	20.75	17	18
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	—	2	1	—	—
	Vicia ervilia	weight	seed	—	—	—	0.013	0.005	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	P
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	0.019
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	2	—	P	P	2	7	12
	Vitis vinifera	weight	seed	0.011	—	0.005	<0.001	0.013	0.066	0.103
	Vitis vinifera	count	pedicel	1	—	—	—	—	1	2
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	2	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	1	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN13D1041s23	KIN13D1044s25	KIN13D1070s71	KIN18A1902s4	KIN16A1683s4	KIN16A1689s26	KIN16A1685s52
			Trench	D	D	D	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D.2a/b	D.2a	D.2a	A1.2b	A1.2a	A1.2a	A1.2a
			context type	pit fill	pit fill	pyro.	layer	layer	layer	layer
			soil volume (l)	3	0.9	12	18	20.75	17	18
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	1	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	3	1	1	8
	Echium sp.	count	nutlet	1	—	—	—	—	—	1
	Heliotropium sp.	count	nutlet	—	—	—	14	1	1	1
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	—	—	4	—	—	1
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	1	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	1
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	1	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	1	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	2	2	2	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	2	2
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	10	5	7	17
	Salsola sp.	count	seed	2	—	—	—	—	—	—
	Suaeda sp.	count	seed	4	1	—	15	1	5	5
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	1
Cyperaceae	Cyperaceae s.l.	count	achene	1	—	—	4	1	8	3
	Cyperaceae s.l.	count	endosperm	—	—	1	3	—	2	1
	Bolboschoenus glaucus	count	achene	—	—	—	3	1	—	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	2	—	—	13	2	4	6
	Carex spp. (trigonous)	count	achene	—	—	—	2	—	—	1
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	3	1	1	1
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	1	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	4	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	1	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN13D1041s23	KIN13D1044s25	KIN13D1070s71	KIN18A1902s4	KIN16A1683s4	KIN16A1689s26	KIN16A1685s52
			Trench	D	D	D	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D.2a/b	D.2a	D.2a	A1.2b	A1.2a	A1.2a	A1.2a
			context type	pit fill	pit fill	pyro.	layer	layer	layer	layer
			soil volume (l)	3	0.9	12	18	20.75	17	18
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	1	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	2	2	1	6	1	4	4
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	1	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	2	—	—	6	4	6	4
	Melilotus- type	count	seed	—	—	—	12	1	—	—
	Trifolium- type	count	seed	1	—	—	12	—	—	—
	Trigonella- type	count	seed	2	—	—	27	1	1	1
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	1	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	1	3	—	—	—	—	2
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	2	1	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	1	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	1	—	—	—
	Bellevalia sp.	count	seed	—	—	1	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	2
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	1	2	1
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	1	—	—	1
	Papaver sp.	count	seed	—	—	—	1	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	2	1	—	16	4	2	—
	Poaceae s.l.	count	rachis internode	—	—	—	1	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	1	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	1	8	—	1
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	1	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	2	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	1	—	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	2	4	2
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	2
	Polygonum aviculare s.l.	count	achene	—	—	—	—	—	—	—

				KIN13D1041s23	KIN13D1044s25	KIN13D1070s71	KIN18A1902s4	KIN16A1683s4	KIN16A1689s26	KIN16A1685s52
			Trench	D	D	D	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D.2a/b	D.2a	D.2a	A1.2b	A1.2a	A1.2a	A1.2a
			context type	pit fill	pit fill	pyro.	layer	layer	layer	layer
			soil volume (l)	3	0.9	12	18	20.75	17	18
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	1	—	—	1
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—	1
	Ceratocephalus falcatus	count	achene	—	—	—	—	1	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	—	—	—	—	—	1	1
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	1	—	—	—	—	5	2
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	1
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	1	—	—	—	1	2	1
	KH-unk1	count	—	864	—	—	—	3	8	—
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	1	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	—	1	—	2	—	3	—
	Indeterminable fragments	weight	—	0.01	<0.001	<0.001	<0.001	0.022	<0.001	0.019
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	2	2	1
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	1	—	1	2
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	1	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	0.005	—	—	—	—	—

				KIN13D1041s23	KIN13D1044s25	KIN13D1070s71	KIN18A1902s4	KIN16A1683s4	KIN16A1689s26	KIN16A1685s52
			Trench	D	D	D	A1	A1	A1	A1
			Period	KH-P IIB	KH-P IIB	KH-P IIB	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D.2a/b	D.2a	D.2a	A1.2b	A1.2a	A1.2a	A1.2a
			context type	pit fill	pit fill	pyro.	layer	layer	layer	layer
			soil volume (l)	3	0.9	12	18	20.75	17	18
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	0.366	0.016	1.778	2.285	29.434	15.08	20.192
	Wood charcoal >4mm	weight	wood	0.24	<0.001	1.36	1.64	45.38	8.92	14.41
	Amorphous material	weight	unknwon	0.006	—	—	0.19	0.176	0.175	0.01
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	0.077	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	3
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	1	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	2	1	5
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	13	32	—	9	—	5	14
	Fimbristylis sp.	count	achene	9	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN16A1721s55	KIN17A1771s64	KIN17A1771s65	KIN17A1771s66	KIN17A1771s67	KIN18A3610s123	KIN16A1711s67
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2b	A1.2b	A1.2b	A1.2b	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	pyro.	layer
			soil volume (l)	10.75	28	30	10	20	18	18.25
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	—	P
	Cerealia	weight	caryopsis	0.014	0.051	0.025	0.005	0.018	—	0.039
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	2	—	1	—	1	—	2
	Hordeum vulgare	weight	caryopsis	0.018	—	0.019	—	0.012	—	0.034
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	—	—	—
	Triticum sp.	weight	caryopsis	—	—	—	—	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	1	—	10	—	2	—	4
	Triticum aestivum /durum	weight	caryopsis	0.01	—	0.075	—	0.018	—	0.043
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	1	—	—	—	P
	Triticum dicoccum	weight	caryopsis	—	—	0.008	—	—	—	0.006
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	1
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	0.007
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	<0.001	—	—	—	<0.001	—	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	1	—	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	1	—	1	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	2	—	1	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	P	—	P	—	0.5
	Pulse indeterminable	weight	seed	—	—	<0.001	—	<0.001	—	0.007
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	1	—	—	—	—	—	—
	Lens culinaris	weight	seed	0.007	—	—	—	—	—	—
Common pea	*Pisum sativum*	count	seed	—	—	1	—	—	—	—
	Pisum sativum	weight	seed	—	—	0.005	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	1	—	—

				KIN16A1721s55	KIN17A1771s64	KIN17A1771s65	KIN17A1771s66	KIN17A1771s67	KIN18A3610s123	KIN16A1711s67
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2b	A1.2b	A1.2b	A1.2b	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	pyro.	layer
			soil volume (l)	10.75	28	30	10	20	18	18.25
	Vicia faba	weight	seed	—	—	—	—	0.006	—	—
Bitter vetch	*Vicia ervilia*	count	seed	1	—	1.5	—	—	—	—
	Vicia ervilia	weight	seed	<0.001	—	0.014	—	—	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	1	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	0.005	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	1	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	0.076	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	P
	Juglans regia	weight	endocarp	—	—	—	—	—	—	0.062
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	10	—	2	—	P	—	P
	Vitis vinifera	weight	seed	0.051	—	0.03	—	<0.001	—	<0.001
	Vitis vinifera	count	pedicel	—	—	—	—	—	—	2
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	1	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN16A1721s55	KIN17A1771s64	KIN17A1771s65	KIN17A1771s66	KIN17A1771s67	KIN18A3610s123	KIN16A1711s67
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2b	A1.2b	A1.2b	A1.2b	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	pyro.	layer
			soil volume (l)	10.75	28	30	10	20	18	18.25
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	5	—	—	—	1	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	1	—	—	1	—	1
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	1
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	1	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	1	—	1	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	1	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	19	4	2	—	—	—	2
	Salsola sp.	count	seed	—	—	—	—	—	—	1
	Suaeda sp.	count	seed	9	2	1	—	3	—	1
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	2	3	2	—	—	—	—
	Cyperaceae s.l.	count	endosperm	—	—	—	—	1	—	—
	Bolboschoenus glaucus	count	achene	—	—	—	1	—	—	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	2	3	1	—	1	—	2
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	1	—	—	—	—	2
	Eleocharis sp.-type 2	count	achene	—	—	1	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	1	1	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN16A1721s55	KIN17A1771s64	KIN17A1771s65	KIN17A1771s66	KIN17A1771s67	KIN18A3610s123	KIN16A1711s67
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2b	A1.2b	A1.2b	A1.2b	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	pyro.	layer
			soil volume (l)	10.75	28	30	10	20	18	18.25
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	1	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	6	—	1	—	—	—	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	—	—	—	—	—	—
	Melilotus- type	count	seed	—	1	5	—	3	—	1
	Trifolium- type	count	seed	—	1	2	—	—	—	1
	Trigonella- type	count	seed	—	1	—	—	1	—	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	1	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	1	—	—	—	—	—	1
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	1	—	—	—	—
	Glaucium sp.	count	seed	1	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	—	4	4	1	1	—	—
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	—	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	1	—	—	—	—	—	1
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	2	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	1	1	—	1	—	—

				KIN16A1721s55	KIN17A1771s64	KIN17A1771s65	KIN17A1771s66	KIN17A1771s67	KIN18A3610s123	KIN16A1711s67
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2b	A1.2b	A1.2b	A1.2b	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	pyro.	layer
			soil volume (l)	10.75	28	30	10	20	18	18.25
	Rumex sp.	count	achene	—	1	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	3	—	—	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	—	—	—	—	1	—	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	1	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	5	—	1	—	—	—	2
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	1	2	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	—	—	2	—	—	—	2
	KH-unk1	count	—	—	5	3	—	6	—	—
	KH-unk2	count	—	3	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	1	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	—	1	—	3	—	—	4
	Indeterminable fragments	weight	—	—	—	<0.001	—	<0.001	—	0.007
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	1
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	1	—	—	—	—	—	78
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	0.004	<0.001	—	—	—	—	0.005

				KIN16A1721s55	KIN17A1771s64	KIN17A1771s65	KIN17A1771s66	KIN17A1771s67	KIN18A3610s123	KIN16A1711s67
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2b	A1.2b	A1.2b	A1.2b	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	pyro.	layer
			soil volume (l)	10.75	28	30	10	20	18	18.25
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	14.107	0.995	0.803	0.162	0.65	nr	19.567
	Wood charcoal >4mm	weight	wood	10.88	0.65	0.31	0	0.17	>100	8.56
	Amorphous material	weight	unknwon	0.088	—	—	—	0.006	—	0.006
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	2	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	2	—	1	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	2	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	1	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	25	2	1	—	—	—	1
	Fimbristylis sp.	count	achene	3	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	1	—	—	—	—	—
	Papaver sp.	count	seed	—	1	2	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN16A1732s70	KIN15A1668s85	KIN18A1996s91	KIN15A1676s93	KIN16A1745s95	KIN13A175s117	KIN15A1685s131
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	6.2	8	28	6.5	13.75	10	11
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	—	P	P	P	—	P
	Cerealia	weight	caryopsis	0.011	—	0.09	0.06	0.01	—	0.013
	Cerealia	count	germ	—	—	—	—	—	1	—
Barley	*Hordeum vulgare*	count	caryopsis	1	—	5	P	P	1	1
	Hordeum vulgare	weight	caryopsis	0.005	—	0.038	0.009	0.009	0.011	0.005
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	1	1	1
	Triticum sp.	weight	caryopsis	—	—	—	—	0.009	0.013	0.005
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	1	2	1	17	10	7	3
	Triticum aestivum /durum	weight	caryopsis	0.005	0.014	0.01	0.169	0.073	0.079	0.017
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	1	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	0.006	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	2	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	0.005	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	1	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	0.001	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	2	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	<0.001	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	—	—	—	0.151	—	0.006
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	—	—	1	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	—	2	—	1
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	1	—	—	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	1	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	2.5	—	—	—	—
	Pulse indeterminable	weight	seed	—	—	0.013	—	—	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	2	0.5	—	—	3
	Lens culinaris	weight	seed	—	—	<0.001	0.004	—	—	0.012
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	1	—	—

				KIN16A1732s70	KIN15A1668s85	KIN18A1996s91	KIN15A1676s93	KIN16A1745s95	KIN13A175s117	KIN15A1685s131
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	6.2	8	28	6.5	13.75	10	11
	Vicia faba	weight	seed	—	—	—	—	0.008	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	—	—	—	—	—
	Vicia ervilia	weight	seed	—	—	—	—	—	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	1
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	<0.001
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	1	—	—	3	—
	Elaeagnus angustifolia	weight	endocarp	—	—	0.018	—	—	0.118	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	1	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	<0.001	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	P	—	P	—
	Juglans regia	weight	endocarp	—	—	—	0.212	—	0.348	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	3	9	1	5	19	29
	Vitis vinifera	weight	seed	—	0.03	0.018	<0.001	0.092	0.259	0.213
	Vitis vinifera	count	pedicel	—	—	—	—	—	—	2
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	1	—	1
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	1	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	6	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	1	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	18	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	1	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN16A1732s70	KIN15A1668s85	KIN18A1996s91	KIN15A1676s93	KIN16A1745s95	KIN13A175s117	KIN15A1685s131
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	6.2	8	28	6.5	13.75	10	11
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	8	—	8	—	7
	Echium sp.	count	nutlet	—	—	—	—	—	—	2
	Heliotropium sp.	count	nutlet	—	—	—	—	—	1	1
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	1	1	2	—	8	—	1
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	1	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	4	—
	Brassica- type	count	seed	—	—	1	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	1	—	1	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	16	2	3
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	7	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	3	—	—
	Chenopodium sp.	count	seed	—	1	16	1	19	2	25
	Salsola sp.	count	seed	—	—	—	—	2	—	—
	Suaeda sp.	count	seed	6	—	1	—	3	—	13
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	2	—	—	—	—	4	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	—	3	—	14	6	2
	Cyperaceae s.l.	count	endosperm	—	—	2	—	29	241	4
	Bolboschoenus glaucus	count	achene	—	—	1	—	1	1	1
	Bolboschoenus sp.	count	achene	—	—	—	—	1	—	—
	Carex spp. (flattened)	count	achene	—	1	9	—	74	667	6
	Carex spp. (trigonous)	count	achene	—	—	—	—	1	5	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	1	—	2	—	—	1	17
	Eleocharis sp.-type 2	count	achene	—	—	—	—	3	—	—
	Fimbristylis sp.	count	achene	—	—	2	—	1	4	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	9	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	2	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	1	—

				KIN16A1732s70	KIN15A1668s85	KIN18A1996s91	KIN15A1676s93	KIN16A1745s95	KIN13A175s117	KIN15A1685s131
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	6.2	8	28	6.5	13.75	10	11
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	2	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	1	—	4	—	21	—	16
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	8	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	1
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	—	3	—	9	1	9
	Melilotus- type	count	seed	—	—	6	—	50	6	4
	Trifolium- type	count	seed	1	—	3	—	41	8	7
	Trigonella- type	count	seed	—	—	—	—	—	—	8
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	1	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	2	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	1
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	1
	cf *Nepeta* sp.	count	nutlet	—	—	1	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	5	—	2	—	1
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	1	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	1	2
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	2	—	—
Poaceae	Poaceae s.l.	count	caryopsis	—	—	6	—	27	58	1
	Poaceae s.l.	count	rachis internode	—	—	1	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	1	—	7	5	1
	Eremopyrum sp.	count	caryopsis	1	—	—	—	11	—	1
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	3	—	—	—	—	1	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	1	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	1	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	1	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	1	1
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	2	—	—	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	1	—	—
	Polygonum sp.	count	achene	—	—	5	—	—	—	35
	Polygonum convolvulus	count	achene	—	—	—	—	2	—	3
	Polygonum aviculare s.l.	count	achene	—	—	6	—	1	—	—

				KIN16A1732s70	KIN15A1668s85	KIN18A1996s91	KIN15A1676s93	KIN16A1745s95	KIN13A175s117	KIN15A1685s131
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	6.2	8	28	6.5	13.75	10	11
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	1	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	3	—	1	1	2
	Ceratocephalus falcatus	count	achene	1	—	—	—	1	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	1	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	2	—
	Galium sp.	count	fruit	—	—	1	—	3	—	2
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	—	1	—	12	5	4
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	1	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	1	1	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	—	—	1	—	2	6	4
	KH-unk1	count	—	—	—	—	—	—	—	—
	KH-unk2	count	—	—	—	—	—	1	—	—
	KH-unk3	count	—	—	—	1	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	1
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	2	—	—	—	19	5	—
	Indeterminable fragments	weight	—	—	—	<0.001	0.027	—	0.01	0.013
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	0.012
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	2	—	5	2	7	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	1	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	2	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	1	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	0.012	<0.001	—	<0.001	—	—

				KIN16A1732s70	KIN15A1668s85	KIN18A1996s91	KIN15A1676s93	KIN16A1745s95	KIN13A175s117	KIN15A1685s131
			Trench	A1	A1	A1	A1	A1	A1	A1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a	A1.2a
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	6.2	8	28	6.5	13.75	10	11
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	8.759	41.66	27.114	16.635	9.367	12.334	7.496
	Wood charcoal >4mm	weight	wood	3.69	44.93	32.84	7.05	4.01	4.94	5.67
	Amorphous material	weight	unknwon	1.756	<0.001	0.054	0.188	0.005	—	0.006
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	1	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	2	—	6	—	8
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	5	—	46	—	17	—	17
	Fimbristylis sp.	count	achene	1	—	2	—	—	—	1
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	1	—
	Trifolieae s.l.	count	seed	—	—	1	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	–	—	—	—	—	—	—	—

				KIN17A1790s135	KIN17A1893s149	KIN17A1894s157	KIN17A1894s158	KIN12A231s258	KIN12A231s260	KIN13B790s152
			Trench	A1	A1	A1	A1	A2	A2	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.3	A1.3	A1.3	A1.3	A2.3	A2.3	B.5
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	20	20	30	10	35	9.5	10
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	—	—	P
	Cerealia	weight	caryopsis	0.078	0.281	0.391	0.097	—	—	0.026
	Cerealia	count	germ	—	2	2	3	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	9	31	64	14	2	1	1
	Hordeum vulgare	weight	caryopsis	0.112	0.335	0.928	0.141	0.008	0.024	0.02
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	1	1	7	—	—	—	—
	Triticum sp.	weight	caryopsis	0.006	0.007	0.04	—	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	7	15	41	4	4	—	4
	Triticum aestivum /durum	weight	caryopsis	0.057	0.149	0.363	0.031	0.033	—	0.026
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	1	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	0.012	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	1
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	0.008
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	1	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	<0.001	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	0.141	0.023	0.015	—	—	<0.001
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	1	26	2	3	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	9	24	2	—	—	2
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	1	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	4	—	10	3	—	—	1
	Triticum aestivum/durum	count	rachis segment frg	—	—	2	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	13	—	—	—	—
	Triticum aestivum	count	rachis segment	1	1	2	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	5.5	1	5.5	—	—	—	1
	Pulse indeterminable	weight	seed	0.031	<0.001	0.081	—	—	—	0.005
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	—	1
	Lens culinaris	weight	seed	—	—	—	—	—	—	0.009
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN17A1790s135	KIN17A1893s149	KIN17A1894s157	KIN17A1894s158	KIN12A231s258	KIN12A231s260	KIN13B790s152
			Trench	A1	A1	A1	A1	A2	A2	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.3	A1.3	A1.3	A1.3	A2.3	A2.3	B.5
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	20	20	30	10	35	9.5	10
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	12.5	139.5	132.5	—	—	1
	Vicia ervilia	weight	seed	—	0.096	1.37	1.188	—	—	0.013
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	1	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	0.007	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	P	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	0.005	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	8	11	2	—	—	—
	Vitis vinifera	weight	seed	—	0.083	0.071	0.02	—	—	—
	Vitis vinifera	count	pedicel	—	4	—	—	—	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	1	—	1	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	1	2	1	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	38	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	1	1	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN17A1790s135	KIN17A1893s149	KIN17A1894s157	KIN17A1894s158	KIN12A231s258	KIN12A231s260	KIN13B790s152
			Trench	A1	A1	A1	A1	A2	A2	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.3	A1.3	A1.3	A1.3	A2.3	A2.3	B.5
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	20	20	30	10	35	9.5	10
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	1	16	4	3	—	—	—
	Echium sp.	count	nutlet	—	—	13	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	4	1	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	9	1	2	2	—	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	1	6	2	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	1	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	1	1	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	5	7	7	—	—	1
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	6	—	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	24	28	11	4	—	—
	Salsola sp.	count	seed	1	6	2	—	—	1	6
	Suaeda sp.	count	seed	—	6	28	8	—	—	3
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	2	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	3	5	9	6	1	—	2
	Cyperaceae s.l.	count	endosperm	2	2	8	3	—	—	—
	Bolboschoenus glaucus	count	achene	1	—	2	—	—	—	—
	Bolboschoenus sp.	count	achene	—	—	—	1	—	—	—
	Carex spp. (flattened)	count	achene	2	10	58	37	4	—	2
	Carex spp. (trigonous)	count	achene	—	2	1	—	1	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	1	22	1	3	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	4	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	1	—	4	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	1	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN17A1790s135	KIN17A1893s149	KIN17A1894s157	KIN17A1894s158	KIN12A231s258	KIN12A231s260	KIN13B790s152
			Trench	A1	A1	A1	A1	A2	A2	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.3	A1.3	A1.3	A1.3	A2.3	A2.3	B.5
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	20	20	30	10	35	9.5	10
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	1	—	—	—	—	1
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	3	3	4	7	—	—	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	2	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	4	8	13	7	3	1	—
	Melilotus- type	count	seed	1	20	39	13	8	—	3
	Trifolium- type	count	seed	2	6	16	6	6	—	—
	Trigonella- type	count	seed	1	12	9	—	1	—	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	2	1	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	5	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	1	5	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	2	—	—	—
	Ornithogalum sp.	count	seed	—	1	1	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	1	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	1	16	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	2	—	1	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	6	27	111	71	3	—	2
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	4	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	2	2	—	—	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	2	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	1	—	—
	Hordeum sp. (wild)	count	rachis internode	—	1	—	—	—	—	1
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	1
	Poa bulbosa	count	floret	—	—	6	1	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	2	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	5	9	5	4	—	1
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	1
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	2	—	3	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	7	1	—	—	—

				KIN17A1790s135	KIN17A1893s149	KIN17A1894s157	KIN17A1894s158	KIN12A231s258	KIN12A231s260	KIN13B790s152
			Trench	A1	A1	A1	A1	A2	A2	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.3	A1.3	A1.3	A1.3	A2.3	A2.3	B.5
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	20	20	30	10	35	9.5	10
	Rumex sp.	count	achene	—	—	1	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	1	1	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	1	—	1	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	2	2	—	—	—	2
	Ceratocephalus falcatus	count	achene	—	2	—	1	—	—	—
	Ranunculus sp.	count	achene	—	—	1	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	1	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	—	14	10	2	—	—	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	2	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	1	11	25	3	—	—	2
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	1	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	2	2	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	3	6	6	11	—	—	—
	KH-unk1	count	—	—	222	25*	—	—	—	26
	KH-unk2	count	—	—	3	—	—	1	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	1	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	1	—	—	—	—	—
	Indeterminable	count	—	2	16	13	1	—	—	—
	Indeterminable fragments	weight	—	<0.001	—	—	0.017	0.006	—	<0.001
	Indeterminable nut fragments	weight	endocarp	—	<0.001	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	1	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	32	9	1	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	<0.001
	Unknown plant part (uncountable)	weight	unknown	<0.001	—	0.005	<0.001	—	—	—

				KIN17A1790s135	KIN17A1893s149	KIN17A1894s157	KIN17A1894s158	KIN12A231s258	KIN12A231s260	KIN13B790s152
			Trench	A1	A1	A1	A1	A2	A2	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	A1.3	A1.3	A1.3	A1.3	A2.3	A2.3	B.5
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	20	20	30	10	35	9.5	10
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	3.06	10.28	3.421	0.14	0.19	0.906	2.472
	Wood charcoal >4mm	weight	wood	2.03	3.9	2.91	0	0	0.3	1.08
	Amorphous material	weight	unknwon	<0.001	1.553	0.795	0.062	<0.001	—	0.036
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	2	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	67	3	6	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	1	10	7	—	—	1	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	1	—	1	—	—	—	—
	Cyperaceae s.l.	count	achene	2	84	61	32	—	—	—
	Fimbristylis sp.	count	achene	—	3	34	17	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	1	163	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	1	—	—	—	—	—	—
unknown	unknown	count	–	—	—	—	—	—	—	—

				KIN14B899s91	KIN13B802s162	KIN13B804s167	KIN14B2002s105	KIN14B2002s106_a	KIN14B2002s106_b	KIN14B807s38_a
			Trench	B	B	B	B	B	B	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.5b-6a	B.6	B.6	B.6a	B.6a	B.6a	B.7
			context type	layer	layer	layer	pyro.	pyro.	pyro.	bin fill
			soil volume (l)	10	10	10	1	6	10	3
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.242	0.086	0.135	0.108	0.521	0.74	0.229
	Cerealia	count	germ	2	—	—	3	26	30	—
Barley	*Hordeum vulgare*	count	caryopsis	13	4	8	3	36	18	6
	Hordeum vulgare	weight	caryopsis	0.104	0.041	0.101	0.024	0.362	0.242	0.06
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	2	—	—	P	6	9	5
	Triticum sp.	weight	caryopsis	<0.001	—	—	0.011	0.061	0.071	0.035
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	38	7	14	22	92	92	32
	Triticum aestivum /durum	weight	caryopsis	0.289	0.083	0.093	0.142	0.81	0.726	0.217
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	3	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	0.021	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	2	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	0.01	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	1	—	1
	Setaria italica	weight	caryopsis	—	—	—	—	<0.001	—	<0.001
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.031	0.711	0.018	<0.001	0.012	<0.001	0.059
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	1	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	1	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	3	11	5	—	—	7	2
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	3	—	1	1	1	1	13
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	1	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	1
Bread wheat	Triticum aestivum	count	rachis segment frg	3	—	1	—	—	1	5
	Triticum aestivum	count	rachis segment	—	1	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	1
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	1	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	2.5	P	—	1.5	0.5	2	—
	Pulse indeterminable	weight	seed	0.026	0.019	—	0.007	<0.001	0.038	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	1	—	—	—	—	2	—
	Lens culinaris	weight	seed	0.006	—	—	—	—	0.008	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN14B899s91	KIN13B802s162	KIN13B804s167	KIN14B2002s105	KIN14B2002s106_a	KIN14B2002s106_b	KIN14B807s38_a
			Trench	B	B	B	B	B	B	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.5b-6a	B.6	B.6	B.6a	B.6a	B.6a	B.7
			context type	layer	layer	layer	pyro.	pyro.	pyro.	bin fill
			soil volume (l)	10	10	10	1	6	10	3
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	1	—	—	—	1	1
	Vicia ervilia	weight	seed	—	0.008	—	—	—	0.01	0.005
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	4	1	—	3	10	6	—
	Vitis vinifera	weight	seed	0.037	0.01	—	0.034	0.052	0.039	—
	Vitis vinifera	count	pedicel	1	1	1	—	—	1	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	10	14	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	1	1	—	1	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	3	—	—	—	2	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	1
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	1	—	—	—	—	—	3
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN14B899s91	KIN13B802s162	KIN13B804s167	KIN14B2002s105	KIN14B2002s106_a	KIN14B2002s106_b	KIN14B807s38_a
			Trench	B	B	B	B	B	B	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.5b-6a	B.6	B.6	B.6a	B.6a	B.6a	B.7
			context type	layer	layer	layer	pyro.	pyro.	pyro.	bin fill
			soil volume (l)	10	10	10	1	6	10	3
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	9	—	—	2	2	3	1
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	6	1	—	2	4	5	195
	Echium sp.	count	nutlet	—	1	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	1	—
	Onosma sp.	count	nutlet	—	—	—	—	1	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	7	2	1	3	4	15	2
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	3	—
	cf *Brassica* -type	count	seed	3	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	1	—	—	1	—	3
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	1	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	1	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	1	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	4	2	—
	Vaccaria pyramidata	count	seed	3	—	1	2	3	1	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	2	—	1	1	10	12	4
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	1	—	—	2	13	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	2	—	—	—
	Chenopodium sp.	count	seed	1	1	—	—	2	15	5
	Salsola sp.	count	seed	18	—	1	1	12	8	—
	Suaeda sp.	count	seed	68	4	3	89	165	130	9
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	13	—	—	—	1	—
	Cyperaceae s.l.	count	endosperm	—	—	2	—	—	1	3
	Bolboschoenus glaucus	count	achene	—	—	1	—	—	—	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	15	11	11	2	6	5	15
	Carex spp. (trigonous)	count	achene	—	5	2	—	—	1	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	9	—	—	—	—	4
	Eleocharis sp.-type 2	count	achene	—	—	1	—	—	—	2
	Fimbristylis sp.	count	achene	—	4	—	—	—	1	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	1	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	1	1	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN14B899s91	KIN13B802s162	KIN13B804s167	KIN14B2002s105	KIN14B2002s106_a	KIN14B2002s106_b	KIN14B807s38_a
			Trench	B	B	B	B	B	B	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.5b-6a	B.6	B.6	B.6a	B.6a	B.6a	B.7
			context type	layer	layer	layer	pyro.	pyro.	pyro.	bin fill
			soil volume (l)	10	10	10	1	6	10	3
	Cephalaria -type	count	achene	1	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	8	—	—	2	2	5	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	1
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	6	5	—	2	2	9	7
	Melilotus- type	count	seed	4	19	11	1	10	5	9
	Trifolium- type	count	seed	—	4	2	2	—	4	4
	Trigonella- type	count	seed	3	5	1	—	3	7	5
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	1	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	2	—	—	1	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	1	1	1	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	13	—	—	1	2	2	—
	Ornithogalum sp.	count	seed	2	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	1	—	2	—	1	1
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	2	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	18	5	14	6	5	17	12
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	1	1	—	2
	Eremopyrum sp.	count	caryopsis	3	—	—	—	4	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	1
	Hordeum sp. (wild)	count	caryopsis	1	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	2
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	1	—	—	—	—	—	1
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	5	—	—	—	7	4	1
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	1	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	1	—	—	1	—	—	—

				KIN14B899s91	KIN13B802s162	KIN13B804s167	KIN14B2002s105	KIN14B2002s106_a	KIN14B2002s106_b	KIN14B807s38_a
			Trench	B	B	B	B	B	B	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.5b-6a	B.6	B.6	B.6a	B.6a	B.6a	B.7
			context type	layer	layer	layer	pyro.	pyro.	pyro.	bin fill
			soil volume (l)	10	10	10	1	6	10	3
	Rumex sp.	count	achene	—	—	1	—	—	—	2
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	5	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—	4
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	1	—	1	—	—	—	3
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	1
	Ranunculus sp.	count	achene	—	1	1	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	2	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	2	—
	Galium sp.	count	fruit	5	2	3	3	3	6	1
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	1	—	1	1	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	1	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	13	6	1	7	19	25	1
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	2
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	4	1	1	—	4	3	68
	KH-unk1	count	—	2224*	187	62	116	116*	457*	56
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	2
	KH-unk4	count	—	—	—	—	—	—	—	1
	KH-unk5	count	—	—	—	1	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	2
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	—	2	3	1	5	15	3
	Indeterminable fragments	weight	—	0.012	0.019	0.015	0.014	0.043	0.012	0.014
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	0.026	0.211
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	1	—	—	1	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	1.268	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	1	—	1	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	1	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	0.009	—	—

				KIN14B899s91	KIN13B802s162	KIN13B804s167	KIN14B2002s105	KIN14B2002s106_a	KIN14B2002s106_b	KIN14B807s38_a
			Trench	B	B	B	B	B	B	B
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.5b-6a	B.6	B.6	B.6a	B.6a	B.6a	B.7
			context type	layer	layer	layer	pyro.	pyro.	pyro.	bin fill
			soil volume (l)	10	10	10	1	6	10	3
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	2.505	2.598	4.953	1.038	1.976	3.317	1.008
	Wood charcoal >4mm	weight	wood	1.76	1.89	2.17	0.16	1.1	1.48	1.16
	Amorphous material	weight	unknwon	0.222	1.434	0.464	0.134	0.292	0.451	0.24
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	1
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	4	2	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	3	1	1	—	4	6	69
	Echium sp.	count	nutlet	—	2	1	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	1	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	—	9	2	—	1	1	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	5	—	—	—	3	2
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	1	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN14B807s38_b	KIN14B807s125	KIN13B807s175	KIN14B817s33	KIN14B876s115	KIN15D2379s117	KIN14D1155s20
			Trench	B	B	B	B	B	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.7	B.7	B.7	B.7	B.7	D1.3	D1.3a
			context type	bin fill	bin fill	bin fill	debris	surface	layer	layer
			soil volume (l)	3	8.5	8.5	9	7.5	15.5	9.5
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.038	0.348	0.123	0.114	0.089	0.162	0.432
	Cerealia	count	germ	—	—	5	1	—	1	—
Barley	*Hordeum vulgare*	count	caryopsis	4	45	16	1	4	6	14
	Hordeum vulgare	weight	caryopsis	0.043	0.4	0.213	0.007	0.059	0.09	0.148
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	3	—	—	1	—
	Triticum sp.	weight	caryopsis	—	—	0.029	—	—	0.008	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	17	27	40	1	6	6	21
	Triticum aestivum /durum	weight	caryopsis	0.129	0.171	0.359	0.007	0.055	0.058	0.131
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	1	—	—	—	1	—
	Secale cereale	weight	caryopsis	—	<0.001	—	—	—	0.008	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	1	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	<0.001	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	1	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	<0.001	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.046	0.08	0.047	—	—	0.063	0.099
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	3	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	1	—	2	3	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	1	24	12	—	—	1	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	10	4	2	—	1	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	4	1	—	1	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	5	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	5	14	1	2	—	—	4
	Triticum aestivum	count	rachis segment	—	2	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	2	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	1	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	2.5	2	—	1	1	0.5
	Pulse indeterminable	weight	seed	—	0.033	0.029	—	<0.001	0.007	0.005
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	1	—	—	—	1	1
	Lens culinaris	weight	seed	—	0.007	—	—	—	0.005	0.027
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN14B807s38_b	KIN14B807s125	KIN13B807s175	KIN14B817s33	KIN14B876s115	KIN15D2379s117	KIN14D1155s20
			Trench	B	B	B	B	B	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.7	B.7	B.7	B.7	B.7	D1.3	D1.3a
			context type	bin fill	bin fill	bin fill	debris	surface	layer	layer
			soil volume (l)	3	8.5	8.5	9	7.5	15.5	9.5
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	7.5	—	—	1	—	—
	Vicia ervilia	weight	seed	—	0.054	—	—	0.005	—	—
Vetch/field pea	*Vicia* /*Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /*Lathyrus*	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus* /*Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /*Malus*	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	1	1	26	—	1	1	5
	Vitis vinifera	weight	seed	0.016	0.012	0.401	—	0.01	0.006	0.083
	Vitis vinifera	count	pedicel	—	2	13	—	—	—	3
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	1	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	1	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	1	—	1	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	4	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	1	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	1	2	4	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN14B807s38_b	KIN14B807s125	KIN13B807s175	KIN14B817s33	KIN14B876s115	KIN15D2379s117	KIN14D1155s20
			Trench	B	B	B	B	B	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.7	B.7	B.7	B.7	B.7	D1.3	D1.3a
			context type	bin fill	bin fill	bin fill	debris	surface	layer	layer
			soil volume (l)	3	8.5	8.5	9	7.5	15.5	9.5
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	2	16	—	1	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	70	11	76	1	1	—	6
	Echium sp.	count	nutlet	1	—	6	—	1	—	—
	Heliotropium sp.	count	nutlet	—	—	1	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	6	5	2	—	—	—	1
	Brassicaceae s.l.	count	silique	—	2	—	—	1	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	2	1	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	1	—	1	—	1	1	—
	Lepidium sp.	count	seed	—	—	1	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	1	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	1
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	3	—	—	—	—
	Silene sp.	count	seed	1	1	5	—	1	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	1	—	—	—	—	1
	Vaccaria pyramidata	count	seed	—	13	—	—	—	1	19
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	5	—	—	—	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	—	4
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	4	10	1	1	1	1	2
	Salsola sp.	count	seed	1	8	4	3	—	3	—
	Suaeda sp.	count	seed	4	21	1	1	3	14	36
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	1	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	2	8	—	1	3	—	3
	Cyperaceae s.l.	count	endosperm	1	2	—	2	4	1	7
	Bolboschoenus glaucus	count	achene	—	—	1	1	1	1	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	10	27	3	1	2	5	2
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	1
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	2	—	—	1	1	—
	Eleocharis sp.-type 2	count	achene	—	4	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	9	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	5	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	4
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN14B807s38_b	KIN14B807s125	KIN13B807s175	KIN14B817s33	KIN14B876s115	KIN15D2379s117	KIN14D1155s20
			Trench	B	B	B	B	B	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.7	B.7	B.7	B.7	B.7	D1.3	D1.3a
			context type	bin fill	bin fill	bin fill	debris	surface	layer	layer
			soil volume (l)	3	8.5	8.5	9	7.5	15.5	9.5
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	1	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	10	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	5	9	19	4	1	—	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	3	—	—	1	2	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	—	16	3	1	1	3
	Melilotus- type	count	seed	8	45	30	2	1	9	17
	Trifolium- type	count	seed	3	3	2	2	—	—	19
	Trigonella- type	count	seed	2	6	5	3	—	6	1
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	1	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	1	1	—	1	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	2	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	1	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	1	1	—	—	1	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	2	—	—	—	—
	Bellevalia sp.	count	seed	—	1	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	1	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	1	1	—	—	1
	Glaucium sp.	count	seed	—	2	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	3	—	—	—	1	—
Poaceae	Poaceae s.l.	count	caryopsis	11	13	8	3	2	4	3
	Poaceae s.l.	count	rachis internode	1	—	1	—	—	—	—
	Poaceae s.l.	count	glume	—	3	1	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	2	5	—	—	—	—
	Eremopyrum sp.	count	caryopsis	1	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	1	—
	Hordeum sp. (wild)	count	caryopsis	—	3	2	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	1	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	2	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	1	—	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	1	5	—	—	—	4
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	2	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	2	—	—	1	1	14

				KIN14B807s38_b	KIN14B807s125	KIN13B807s175	KIN14B817s33	KIN14B876s115	KIN15D2379s117	KIN14D1155s20
			Trench	B	B	B	B	B	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.7	B.7	B.7	B.7	B.7	D1.3	D1.3a
			context type	bin fill	bin fill	bin fill	debris	surface	layer	layer
			soil volume (l)	3	8.5	8.5	9	7.5	15.5	9.5
	Rumex sp.	count	achene	3	—	9	—	—	—	2
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	2	—	1	—	1	2
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	1	1	22	—	1	1	1
	Ceratocephalus falcatus	count	achene	2	1	2	1	1	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	2	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	1	13	3	—	1	—	2
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	1	—	—	1	1	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	1	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	2	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	1	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	3	11	—	1	2	5
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	1	3	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	3	10	1	—	2	2	2
	KH-unk1	count	—	47	97	11	26	50	1065*	31
	KH-unk2	count	—	—	—	—	—	2	—	—
	KH-unk3	count	—	1	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	1	—	1	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	5	8	13	—	—	1	4
	Indeterminable fragments	weight	—	0.028	0.048	0.01	<0.001	0.005	—	0.033
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	0.301	0.105	1.982	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	4	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	1	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	2	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	4	—	—	—	—	1
	Unknown plant part (uncountable)	weight	unknown	—	—	<0.001	—	—	—	—

				KIN14B807s38_b	KIN14B807s125	KIN13B807s175	KIN14B817s33	KIN14B876s115	KIN15D2379s117	KIN14D1155s20
			Trench	B	B	B	B	B	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	B.7	B.7	B.7	B.7	B.7	D1.3	D1.3a
			context type	bin fill	bin fill	bin fill	debris	surface	layer	layer
			soil volume (l)	3	8.5	8.5	9	7.5	15.5	9.5
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	0.594	4.477	5.082	2.291	1.732	1.825	1.288
	Wood charcoal >4mm	weight	wood	0.46	2.23	2.23	1.04	1.48	1.18	0.77
	Amorphous material	weight	unknwon	4.985	0.397	0.764	0.101	0.123	0.176	0.1
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	1	5	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	27	7	51	—	—	7	3
	Echium sp.	count	nutlet	—	3	3	—	3	1	—
	Heliotropium sp.	count	nutlet	—	1	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	1	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	2	39	—	1	2	4	1
	Fimbristylis sp.	count	achene	—	3	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	1	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	3
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	3	1	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	1	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	–	—	—	—	—	—	—	—

				KIN13D1073s67	KIN14D1124s4	KIN14D1149s73	KIN13D1144s185	KIN15D2376s140	KIN14D1166s52a	KIN14D1166s52b
			Trench	D1	D1	D1	D1	D1	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3a	D1.3a	D1.3a	D1.3a	D1.3b	D1.3b	D1.3b
			context type	layer	surface	surface	surface	pit fill	pyro.	pyro.
			soil volume (l)	2.5	4.5	2.5	4.8	17.5	3.6	2.6
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.008	0.033	0.081	0.187	0.063	0.043	0.036
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	P	P	3	4	2	1	P
	Hordeum vulgare	weight	caryopsis	0.005	0.006	0.026	0.034	0.009	0.011	0.007
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	—	1	—
	Triticum sp.	weight	caryopsis	—	—	—	—	—	0.005	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	—	2	3	3	3	4	3
	Triticum aestivum /durum	weight	caryopsis	—	0.012	0.023	0.019	0.026	0.033	0.019
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	—	0.019	—	0.022	—	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	1	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	—	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	—	1	1	1
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	1	1	—	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	—	—	0.5	—	1
	Pulse indeterminable	weight	seed	—	—	—	—	0.005	—	0.008
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	—	—
	Lens culinaris	weight	seed	—	—	—	—	—	—	—
Common pea	*Pisum sativum*	count	seed	—	2.5	—	—	—	—	1
	Pisum sativum	weight	seed	—	0.023	—	—	—	—	0.03
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN13D1073s67	KIN14D1124s4	KIN14D1149s73	KIN13D1144s185	KIN15D2376s140	KIN14D1166s52a	KIN14D1166s52b
			Trench	D1	D1	D1	D1	D1	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3a	D1.3a	D1.3a	D1.3a	D1.3b	D1.3b	D1.3b
			context type	layer	surface	surface	surface	pit fill	pyro.	pyro.
			soil volume (l)	2.5	4.5	2.5	4.8	17.5	3.6	2.6
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	1.5	—	—	0.5	—
	Vicia ervilia	weight	seed	—	—	0.008	—	—	0.005	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	1	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	0.02	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	14	1	41	P	1	—
	Vitis vinifera	weight	seed	—	0.143	0.012	0.745	<0.001	0.012	—
	Vitis vinifera	count	pedicel	—	20	—	58	—	2	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	1	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN13D1073s67	KIN14D1124s4	KIN14D1149s73	KIN13D1144s185	KIN15D2376s140	KIN14D1166s52a	KIN14D1166s52b
			Trench	D1	D1	D1	D1	D1	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3a	D1.3a	D1.3a	D1.3a	D1.3b	D1.3b	D1.3b
			context type	layer	surface	surface	surface	pit fill	pyro.	pyro.
			soil volume (l)	2.5	4.5	2.5	4.8	17.5	3.6	2.6
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	1	1	2	1	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	1	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	—	—	—	—	1	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	4	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	1	—	—	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Salsola sp.	count	seed	—	—	1	1	—	—	—
	Suaeda sp.	count	seed	—	—	10	50	20	—	—
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	2	4	—	—	—	—
	Cyperaceae s.l.	count	endosperm	—	—	14	3	—	—	—
	Bolboschoenus glaucus	count	achene	—	—	1	1	—	—	—
	Bolboschoenus sp.	count	achene	—	3	—	—	—	—	—
	Carex spp. (flattened)	count	achene	—	4	13	13	1	—	—
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	1	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	1	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN13D1073s67	KIN14D1124s4	KIN14D1149s73	KIN13D1144s185	KIN15D2376s140	KIN14D1166s52a	KIN14D1166s52b
			Trench	D1	D1	D1	D1	D1	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3a	D1.3a	D1.3a	D1.3a	D1.3b	D1.3b	D1.3b
			context type	layer	surface	surface	surface	pit fill	pyro.	pyro.
			soil volume (l)	2.5	4.5	2.5	4.8	17.5	3.6	2.6
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	1	6	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	—	1	1	—	—	—
	Melilotus- type	count	seed	—	13	15	4	1	—	—
	Trifolium- type	count	seed	—	2	39	2	2	—	—
	Trigonella- type	count	seed	—	—	2	5	—	—	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	2	2	1	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	1	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	—	—	6	9	2	—	2
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	—	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	3	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	1	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	—	—	—

				KIN13D1073s67	KIN14D1124s4	KIN14D1149s73	KIN13D1144s185	KIN15D2376s140	KIN14D1166s52a	KIN14D1166s52b
			Trench	D1	D1	D1	D1	D1	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3a	D1.3a	D1.3a	D1.3a	D1.3b	D1.3b	D1.3b
			context type	layer	surface	surface	surface	pit fill	pyro.	pyro.
			soil volume (l)	2.5	4.5	2.5	4.8	17.5	3.6	2.6
	Rumex sp.	count	achene	—	—	1	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	1	3	—	—	1
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	1	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	1	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	1
	Galium sp.	count	fruit	—	—	3	1	—	—	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	—	1	—	—	—	—
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	3	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	—	1	3	5	—	—	—
	KH-unk1	count	—	—	2	—	—	—	22*	35
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	2	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	1	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	3	—	—	—
	Indeterminable	count	—	—	—	4	3	—	—	—
	Indeterminable fragments	weight	—	<0.001	<0.001	0.001	<0.001	0.005	<0.001	—
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	1	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN13D1073s67	KIN14D1124s4	KIN14D1149s73	KIN13D1144s185	KIN15D2376s140	KIN14D1166s52a	KIN14D1166s52b
			Trench	D1	D1	D1	D1	D1	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3a	D1.3a	D1.3a	D1.3a	D1.3b	D1.3b	D1.3b
			context type	layer	surface	surface	surface	pit fill	pyro.	pyro.
			soil volume (l)	2.5	4.5	2.5	4.8	17.5	3.6	2.6
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	0.026	0.447	0.462	0.312	0.192	0.474	0.239
	Wood charcoal >4mm	weight	wood	0	0.14	0.2	0.04	0.2	0.17	<0.001
	Amorphous material	weight	unknwon	—	0.189	0.394	0.08	0.007	<0.001	<0.001
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	3	3	2	38	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	—	3	3	7	3	—	—
	Fimbristylis sp.	count	achene	—	—	—	2	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN14D2302s102	KIN14D1166s138	KIN14D1109s95	KIN14D2314s140	KIN14D1192s88	KIN14D1192s101	KIN14D2385s150
			Trench	D1	D1	D1	D1	D2	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3b	D1.3b	D1.3b	D1.3b	D1.3c	D1.3c	D1.3c
			context type	pyro.	pyro.	surface	surface	pyro.	pyro.	surface
			soil volume (l)	10	9	1.5	8	9	3	12
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.17	0.031	0.064	0.111	0.083	0.121	0.16
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	3	—	6	4	1	5	2
	Hordeum vulgare	weight	caryopsis	0.049	—	0.034	0.036	0.018	0.043	0.036
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	—	1	—
	Triticum sp.	weight	caryopsis	—	—	—	—	—	<0.001	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	7	—	3	1	5	2	10
	Triticum aestivum /durum	weight	caryopsis	0.044	—	0.015	0.01	0.008	0.005	0.11
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	<0.001	0.017	0.009	0.033	—	—	<0.001
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	2	2	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	—	—	—	1
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	2	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	—	3	—	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	—	—	P	1.5	1.5
	Pulse indeterminable	weight	seed	—	—	—	—	<0.001	0.007	0.015
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	1	3	—
	Lens culinaris	weight	seed	—	—	—	—	0.005	0.012	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN14D2302s102	KIN14D1166s138	KIN14D1109s95	KIN14D2314s140	KIN14D1192s88	KIN14D1192s101	KIN14D2385s150
			Trench	D1	D1	D1	D1	D2	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3b	D1.3b	D1.3b	D1.3b	D1.3c	D1.3c	D1.3c
			context type	pyro.	pyro.	surface	surface	pyro.	pyro.	surface
			soil volume (l)	10	9	1.5	8	9	3	12
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	—	1	—	1	—
	Vicia ervilia	weight	seed	—	—	—	0.006	—	0.007	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	P	—	—	2	P	—	2
	Vitis vinifera	weight	seed	<0.001	—	—	0.017	<0.001	—	0.013
	Vitis vinifera	count	pedicel	—	—	—	—	—	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	72
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	3	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN14D2302s102	KIN14D1166s138	KIN14D1109s95	KIN14D2314s140	KIN14D1192s88	KIN14D1192s101	KIN14D2385s150
			Trench	D1	D1	D1	D1	D2	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3b	D1.3b	D1.3b	D1.3b	D1.3c	D1.3c	D1.3c
			context type	pyro.	pyro.	surface	surface	pyro.	pyro.	surface
			soil volume (l)	10	9	1.5	8	9	3	12
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	1	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	2	3	2	1	3	7	5
	Echium sp.	count	nutlet	—	—	—	17	37	—	3
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	—	—	—	5	1	1
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	2
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	1	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	1	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	1	—	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	1	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	3	1	—	—
	Salsola sp.	count	seed	—	—	—	1	—	—	9
	Suaeda sp.	count	seed	7	1	1	8	14	4	9
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	2	—	2	1	—	—
	Cyperaceae s.l.	count	endosperm	—	—	2	2	1	—	—
	Bolboschoenus glaucus	count	achene	1	—	—	—	—	—	5
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	1	8	5	4	4	4	14
	Carex spp. (trigonous)	count	achene	—	1	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	1	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	1	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	1	1	1
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN14D2302s102	KIN14D1166s138	KIN14D1109s95	KIN14D2314s140	KIN14D1192s88	KIN14D1192s101	KIN14D2385s150
			Trench	D1	D1	D1	D1	D2	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3b	D1.3b	D1.3b	D1.3b	D1.3c	D1.3c	D1.3c
			context type	pyro.	pyro.	surface	surface	pyro.	pyro.	surface
			soil volume (l)	10	9	1.5	8	9	3	12
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	3	2	—	—	1	—	1
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	2
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	—	1	—	—	—	2
	Melilotus- type	count	seed	—	6	—	5	2	—	6
	Trifolium- type	count	seed	—	—	1	4	—	3	1
	Trigonella- type	count	seed	—	1	—	3	1	—	4
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	2
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	1	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	1	—	—	—	—	—	1
	Glaucium sp.	count	seed	—	1	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	1	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	3	—	4	2	4	2	18
	Poaceae s.l.	count	rachis internode	—	—	—	—	1	1	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	1
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	1	—	—	—	1	1
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	1	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	2	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	2	—	—	—	1
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	—	—	—

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			Trench	D1	D1	D1	D1	D2	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3b	D1.3b	D1.3b	D1.3b	D1.3c	D1.3c	D1.3c
			context type	pyro.	pyro.	surface	surface	pyro.	pyro.	surface
			soil volume (l)	10	9	1.5	8	9	3	12
	Rumex sp.	count	achene	1	—	—	1	—	—	6
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	1	—	—	—	—	2
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /*Asperula*	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /*orientalis*	count	fruit	—	—	—	1	—	—	1
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	—	—	—	—	1	—	3
Scrophulariaceae	*Scrophularia* /*Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	—	—	2	—	—	1
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	1	—	—	1
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	—	—	—	—	—	—	4
	KH-unk1	count	—	—	3630*	—	10	8	—	976
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	1
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	4	1	—	2	3	3	—
	Indeterminable fragments	weight	—	—	—	—	<0.001	0.011	0.005	<0.001
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	1	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	1	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN14D2302s102	KIN14D1166s138	KIN14D1109s95	KIN14D2314s140	KIN14D1192s88	KIN14D1192s101	KIN14D2385s150
			Trench	D1	D1	D1	D1	D2	D1	D1
			Period	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III	KH-P III
			Phase	D1.3b	D1.3b	D1.3b	D1.3b	D1.3c	D1.3c	D1.3c
			context type	pyro.	pyro.	surface	surface	pyro.	pyro.	surface
			soil volume (l)	10	9	1.5	8	9	3	12
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	0.181	1.285	0.025	0.89	0.181	0.016	1.728
	Wood charcoal >4mm	weight	wood	0.5	1.54	0	0.15	0	0	0.4
	Amorphous material	weight	unknwon	0.011	0.02	0.022	0.219	0.013	—	0.228
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	40
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	1	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	7	—	2	2	2	—
	Echium sp.	count	nutlet	—	1	—	7	796	309	4
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	2	—	—	1	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	6	—	—
	Cyperaceae s.l.	count	achene	—	11	4	1	12	1	3
	Fimbristylis sp.	count	achene	—	—	—	—	—	3	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	1	—	—	—	2	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	1	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	1	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	1	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	13	—	—

				KIN16D2416s37	KIN15D2348s38	KIN15D2313s74	KIN17A1878s165	KIN12A249s256	KIN12A250s267	KIN12A281s300
			Trench	D1	D1	D1	A1	A2	A2	A2
			Period	KH-P III	KH-P III	KH-P III	KH-PIV	KH-P IV	KH-P IV	KH-P IV
			Phase	D1.4a	D1.4a	D1.4a	A1.4	A2.4a	A2.4a	A2.4a
			context type	fire layer	pyro.	pyro.	pit fill	layer	layer	layer
			soil volume (l)	11	20	7.5	8	3	6	2
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	1	P	—	P	P
	Cerealia	weight	caryopsis	0.091	0.287	0.323	0.182	—	0.008	0.029
	Cerealia	count	germ	—	—	1	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	9	27	4	21	—	—	1
	Hordeum vulgare	weight	caryopsis	0.086	0.238	0.023	0.192	—	—	0.01
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	1	—	—	—	—	—
	Triticum sp.	weight	caryopsis	—	0.017	—	—	—	—	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	19	3	3	33	—	—	3
	Triticum aestivum /durum	weight	caryopsis	0.155	0.046	0.014	0.257	—	—	0.024
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	2	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	0.016	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.167	—	—	0.065	—	<0.001	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	4	—	1	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	17	—	—	2	—	1	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	15	—	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	5	—	—	—
	Triticum aestivum/durum	count	rachis segment	1	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	4	—	—	1	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	6	1	—	13	—	—	—
	Triticum aestivum	count	rachis segment	—	—	—	1	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	1.5	—	1.5	—	—	—	0.5
	Pulse indeterminable	weight	seed	0.015	—	0.015	—	—	—	<0.001
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	2	—	—	—	—	7
	Lens culinaris	weight	seed	—	0.011	—	—	—	—	0.04
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	1	—	—	—	—	—

				KIN16D2416s37	KIN15D2348s38	KIN15D2313s74	KIN17A1878s165	KIN12A249s256	KIN12A250s267	KIN12A281s300
			Trench	D1	D1	D1	A1	A2	A2	A2
			Period	KH-P III	KH-P III	KH-P III	KH-PIV	KH-P IV	KH-P IV	KH-P IV
			Phase	D1.4a	D1.4a	D1.4a	A1.4	A2.4a	A2.4a	A2.4a
			context type	fire layer	pyro.	pyro.	pit fill	layer	layer	layer
			soil volume (l)	11	20	7.5	8	3	6	2
	Vicia faba	weight	seed	—	0.018	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	2.5	—	2	—	—	—
	Vicia ervilia	weight	seed	—	0.019	—	0.019	—	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	4	—	1	—	—	8	P
	Vitis vinifera	weight	seed	0.045	—	0.007	—	—	0.087	0.005
	Vitis vinifera	count	pedicel	1	—	—	—	—	8	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	1	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	0.005	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	1	—	—	—	—	1	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	1	—	—	—
	Bupleurum -type	count	schizocarp	—	1	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	6	—	—	1	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	1	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	2	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	2	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN16D2416s37	KIN15D2348s38	KIN15D2313s74	KIN17A1878s165	KIN12A249s256	KIN12A250s267	KIN12A281s300
			Trench	D1	D1	D1	A1	A2	A2	A2
			Period	KH-P III	KH-P III	KH-P III	KH-PIV	KH-P IV	KH-P IV	KH-P IV
			Phase	D1.4a	D1.4a	D1.4a	A1.4	A2.4a	A2.4a	A2.4a
			context type	fire layer	pyro.	pyro.	pit fill	layer	layer	layer
			soil volume (l)	11	20	7.5	8	3	6	2
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	1	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	1	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	1	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	1	6	19	—	—	—	—
	Echium sp.	count	nutlet	1	2	34	—	—	—	—
	Heliotropium sp.	count	nutlet	2	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	67	1	—	4	—	3	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	5	1	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	1	—	—	5	—	—	2
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	2	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	2	—	—	1	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	1	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	1	—	1	—	—	—
	cf *Silene* sp.	count	seed	—	1	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	9	2	—	1	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	11	3	—	3	—	11	—
	Atriplex sp.	count	bract	1	—	—	—	—	—	—
	Atriplex sp.	count	seed	75	3	1	—	—	10	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	8	3	—	—	—	22	—
	Salsola sp.	count	seed	—	4	—	3	—	4	9
	Suaeda sp.	count	seed	1287	11	1	—	—	—	—
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	26	1	—	—	—	1	—
	Cyperaceae s.l.	count	endosperm	48	2	—	—	—	2	—
	Bolboschoenus glaucus	count	achene	5	1	—	—	—	—	3
	Bolboschoenus sp.	count	achene	—	—	—	1	—	—	—
	Carex spp. (flattened)	count	achene	707	—	—	8	—	3	4
	Carex spp. (trigonous)	count	achene	7	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	1	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	1	—	—	3	—	—	1
	Eleocharis sp.-type 2	count	achene	9	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	19	—	—	1	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	3	1	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

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			Trench	D1	D1	D1	A1	A2	A2	A2
			Period	KH-P III	KH-P III	KH-P III	KH-PIV	KH-P IV	KH-P IV	KH-P IV
			Phase	D1.4a	D1.4a	D1.4a	A1.4	A2.4a	A2.4a	A2.4a
			context type	fire layer	pyro.	pyro.	pit fill	layer	layer	layer
			soil volume (l)	11	20	7.5	8	3	6	2
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	1	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	114	—	—	5	—	3	4
	Trifolieae s.l.	count	pod	2	—	—	—	—	—	—
	Astragalus- type	count	seed	1	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	1
	Medicago sp.	count	pod	2	—	—	—	—	—	—
	Medicago- type	count	seed	31	5	—	1	—	13	2
	Melilotus- type	count	seed	47	63	3	—	—	2	3
	Trifolium- type	count	seed	204	37	—	—	—	2	3
	Trigonella- type	count	seed	62	2	—	3	—	1	—
	Coronilla-type	count	seed	3	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	1	—	—	1	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	3	—	—	—	—	1	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	1	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	1	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	1	—	—	1	—	—	—
	Bellevalia sp.	count	seed	—	—	—	1	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	1	—
Malvaceae	*Malva* sp.	count	seed	12	—	—	—	—	—	2
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	1	—
	Glaucium sp.	count	seed	—	—	—	1	—	—	—
	Papaver sp.	count	seed	—	—	—	1	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	8	—	—	—	—	2	—
Poaceae	Poaceae s.l.	count	caryopsis	544	14	—	11	—	8	4
	Poaceae s.l.	count	rachis internode	1	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	1	—	—	—
	Poaceae s.l.	count	awn	3	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	3	—	—	—
	Bromus sp.	count	caryopsis	79	4	—	1	—	2	1
	Eremopyrum sp.	count	caryopsis	4	—	—	—	—	5	—
	Festuca- type	count	caryopsis	14	1	—	—	—	1	—
	Hordeum sp. (wild)	count	caryopsis	10	1	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	1	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	26	—	—	—	—	—	—
	Poa bulbosa	count	floret	3	—	—	—	—	4	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	7	—	—	2	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	2	1	—	—	—	—	1
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	1	—	1	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	5	—	—	—	—	—	—

				KIN16D2416s37	KIN15D2348s38	KIN15D2313s74	KIN17A1878s165	KIN12A249s256	KIN12A250s267	KIN12A281s300
			Trench	D1	D1	D1	A1	A2	A2	A2
			Period	KH-P III	KH-P III	KH-P III	KH-PIV	KH-P IV	KH-P IV	KH-P IV
			Phase	D1.4a	D1.4a	D1.4a	A1.4	A2.4a	A2.4a	A2.4a
			context type	fire layer	pyro.	pyro.	pit fill	layer	layer	layer
			soil volume (l)	11	20	7.5	8	3	6	2
	Rumex sp.	count	achene	13	—	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	1	—
Primulaceae	*Androsace maxima*	count	seed	1	3	—	—	—	—	2
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	2	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	1	2	—	—	—	1	—
	Asperula sp.	count	fruit	—	2	—	—	—	—	—
	Galium sp.	count	fruit	14	2	—	6	—	1	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	1	3	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	1	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	15	6	—	2	—	3	2
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	20	—	—	—	—	1	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	4	5	—	5	—	1	2
	KH-unk1	count	—	—	22	—	—	—	—	—
	KH-unk2	count	—	—	—	—	1	—	1	—
	KH-unk3	count	—	—	—	—	1	—	3	1
	KH-unk4	count	—	—	—	—	1	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	16	2	1	5	—	—	—
	Indeterminable fragments	weight	—	0.06	—	<0.001	0.013	—	0.012	<0.001
	Indeterminable nut fragments	weight	endocarp	0.005	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	uncountal	—	—	—	—
	Bark fragment	count	bark	1	—	—	—	—	—	—
	Bud	count	bud	4	—	—	1	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	1	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	0.04	—	—	—	—	—	—

				KIN16D2416s37	KIN15D2348s38	KIN15D2313s74	KIN17A1878s165	KIN12A249s256	KIN12A250s267	KIN12A281s300
			Trench	D1	D1	D1	A1	A2	A2	A2
			Period	KH-P III	KH-P III	KH-P III	KH-PIV	KH-P IV	KH-P IV	KH-P IV
			Phase	D1.4a	D1.4a	D1.4a	A1.4	A2.4a	A2.4a	A2.4a
			context type	fire layer	pyro.	pyro.	pit fill	layer	layer	layer
			soil volume (l)	11	20	7.5	8	3	6	2
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	2.219	0.889	0.047	2.456	0	1.692	0.833
	Wood charcoal >4mm	weight	wood	1.04	0.12	0	1.49	0.04	0.61	0.07
	Amorphous material	weight	unknwon	1.939	0.079	0.008	0.056	—	0.2	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	1	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	1	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	2	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	5	—	7	—	1	—
	Echium sp.	count	nutlet	—	11	36	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	1	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	1	—	—	—	—	—
	Cyperaceae s.l.	count	achene	3	16	—	1	—	—	2
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN18A1379s31	KIN12A291s313	KIN18A1377s3	KIN18A1397s36	KIN18C2874s5	KIN15C2520s11	KIN17C2683s13
			Trench	A2	A1	A2	A2	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	A2.4a	A2.4a	A2.4b	A2.4b	C3E.2	C3E.2	C3E.2
			context type	pyro.	surface	layer	pyro.	surface	pit fill	layer
			soil volume (l)	27	12	31	10	18	46	15
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	1	P	P	P	P
	Cerealia	weight	caryopsis	0.309	0.022	0.367	0.011	0.455	0.162	0.022
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	42	5	21	2	44	16	5
	Hordeum vulgare	weight	caryopsis	0.552	0.052	0.242	0.04	0.552	0.175	0.04
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	16	3	3	1	1	—	2
	Triticum sp.	weight	caryopsis	0.172	0.008	0.039	0.006	0.011	—	0.012
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	53	10	17	5	6	11	4
	Triticum aestivum /durum	weight	caryopsis	0.432	0.089	0.135	0.043	0.059	0.07	0.035
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	2	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	<0.001	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	<0.001	—	<0.001	—	<0.001	<0.001	<0.001
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	1	3	3	—	—	2	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	1	—	1	—	1	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	1	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	1	6	7	—	—	1	—
	Triticum aestivum/durum	count	rachis segment frg	—	1	1	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	—	—	1	—	—
	Triticum aestivum	count	rachis segment	—	2	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	1.5	6.5	—	—	1	—	P
	Pulse indeterminable	weight	seed	0.005	0.057	—	—	0.013	—	<0.001
Chickpea	*Cicer arietinum*	count	seed	1	—	—	—	—	—	—
	Cicer arietinum	weight	seed	0.032	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	3	—	—	—	—	—	—
	Lens culinaris	weight	seed	0.034	—	—	—	—	—	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN18A1379s31	KIN12A291s313	KIN18A1377s3	KIN18A1397s36	KIN18C2874s5	KIN15C2520s11	KIN17C2683s13
			Trench	A2	A1	A2	A2	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	A2.4a	A2.4a	A2.4b	A2.4b	C3E.2	C3E.2	C3E.2
			context type	pyro.	surface	layer	pyro.	surface	pit fill	layer
			soil volume (l)	27	12	31	10	18	46	15
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	2	—	—	—	—	—
	Vicia ervilia	weight	seed	—	0.022	—	—	—	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	8	9	4	2	P	1	1
	Vitis vinifera	weight	seed	0.066	0.094	0.042	0.021	<0.001	0.013	<0.001
	Vitis vinifera	count	pedicel	—	—	2	—	1	2	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	1	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	<0.001	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	5	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	4	—	2	—	—	3	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	1	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	1	—	—	—	2	—	—
	Cichorium sp.	count	achene	—	—	—	—	1	—	—

				KIN18A1379s31	KIN12A291s313	KIN18A1377s3	KIN18A1397s36	KIN18C2874s5	KIN15C2520s11	KIN17C2683s13
			Trench	A2	A1	A2	A2	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	A2.4a	A2.4a	A2.4b	A2.4b	C3E.2	C3E.2	C3E.2
			context type	pyro.	surface	layer	pyro.	surface	pit fill	layer
			soil volume (l)	27	12	31	10	18	46	15
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	1	1	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	1	—	3	—	1	1	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	1
Brassicaceae	Brassicaceae s.l.	count	seed	1	—	—	—	—	1	2
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	1	—	—	—	—	2	2
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	1	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	10	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	1	1
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	1	—	—	2	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	1	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	38	1	—	—	—	1	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	4	—	2	2	—	—	2
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	51	—	—	—	3	1	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	8	1	—	—	5	8	3
	Salsola sp.	count	seed	—	—	2	—	—	3	—
	Suaeda sp.	count	seed	8	—	2	1	3	8	2
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	5	—	1	1	3	3	2
	Cyperaceae s.l.	count	endosperm	2	1	9	2	3	5	1
	Bolboschoenus glaucus	count	achene	1	2	7	—	1	—	1
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	46	13	14	6	3	12	1
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	4	—	4	1	—	2	—
	Eleocharis sp.-type 2	count	achene	—	—	1	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	1	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN18A1379s31	KIN12A291s313	KIN18A1377s3	KIN18A1397s36	KIN18C2874s5	KIN15C2520s11	KIN17C2683s13
			Trench	A2	A1	A2	A2	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	A2.4a	A2.4a	A2.4b	A2.4b	C3E.2	C3E.2	C3E.2
			context type	pyro.	surface	layer	pyro.	surface	pit fill	layer
			soil volume (l)	27	12	31	10	18	46	15
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	1	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	1	—	—	—	1	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	16	—	6	4	1	—	1
	Trifolieae s.l.	count	pod	—	—	—	—	—	1	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	14	1	7	—	2	1	14
	Melilotus- type	count	seed	15	17	4	2	2	1	4
	Trifolium- type	count	seed	40	3	6	—	1	2	1
	Trigonella- type	count	seed	2	1	2	1	1	5	5
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	1	—	—	1	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	1	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	1	—	1	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	1	—	—	—	—	1	—
	Ornithogalum sp.	count	seed	—	1	2	—	1	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	1	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	15	2	—	1	1	10	—
	Poaceae s.l.	count	rachis internode	—	1	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	1	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	1	—	—	—	—	—	1
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	1	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	2	—	—	1	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	2	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	1	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	1	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	1	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	2	—	—	—	1	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	2	—	—	—	3
	Polygonum convolvulus	count	achene	—	—	—	—	—	1	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	—	1	—

				KIN18A1379s31	KIN12A291s313	KIN18A1377s3	KIN18A1397s36	KIN18C2874s5	KIN15C2520s11	KIN17C2683s13
			Trench	A2	A1	A2	A2	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	A2.4a	A2.4a	A2.4b	A2.4b	C3E.2	C3E.2	C3E.2
			context type	pyro.	surface	layer	pyro.	surface	pit fill	layer
			soil volume (l)	27	12	31	10	18	46	15
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	1	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	1	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	1	—	1	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	5	2	1	—	8	1	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	1	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	8	1	3	1	—	4	1
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	1	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	5	1	—	—	—	2	—
	KH-unk1	count	—	—	—	—	—	—	—	—
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	1	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	1	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	14	1	6	—	—	1	2
	Indeterminable fragments	weight	—	0.024	<0.001	0.007	—	<0.001	<0.001	<0.001
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	1	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	5	—	3	—	—	3	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	1	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN18A1379s31	KIN12A291s313	KIN18A1377s3	KIN18A1397s36	KIN18C2874s5	KIN15C2520s11	KIN17C2683s13
			Trench	A2	A1	A2	A2	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	A2.4a	A2.4a	A2.4b	A2.4b	C3E.2	C3E.2	C3E.2
			context type	pyro.	surface	layer	pyro.	surface	pit fill	layer
			soil volume (l)	27	12	31	10	18	46	15
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	7.631	1.061	12.583	1.989	4.265	5.698	1.17
	Wood charcoal >4mm	weight	wood	4.21	0.065	7.47	1.04	1.03	2.26	0.49
	Amorphous material	weight	unknwon	0.318	0.043	0.046	—	0.077	0.068	0.022
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	1	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	1	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	1	1	—	1	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	2	1	—	—	2	15	—
	Echium sp.	count	nutlet	—	—	—	1	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	1	—	6	—
	Lepidium perfoliatum	count	seed	—	—	1	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	7	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	1	—
	Vaccaria pyramidata	count	seed	—	—	—	3	—	16	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	1	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	2	—
	Suaeda sp.	count	seed	—	—	—	—	—	1	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	4	—
	Cyperaceae s.l.	count	achene	—	2	12	1	—	1	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	2	—	—	—	—	1	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	1	—
	Rumex sp.	count	achene	—	—	—	1	—	6	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	1	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	2	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	1	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	5	—

				KIN18C2870s15	KIN17C2805s16	KIN17C2814s27	KIN17C642s30	KIN17C2825s38	KIN17C2830s40	KIN16C2659s47
			Trench	C3E	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2
			context type	pit fill	pit fill	pit fill	surface	pit fill	pit fill	surface
			soil volume (l)	38	14.5	18	9	8	13	4.25
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.157	0.035	0.017	0.007	0.008	0.017	0.041
	Cerealia	count	germ	1	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	—	—	4	—	2	6	4
	Hordeum vulgare	weight	caryopsis	—	—	0.043	—	0.013	0.034	0.026
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	8	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	0.082	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	—	—	—	1
	Triticum sp.	weight	caryopsis	—	—	—	—	—	—	<0.001
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	16	7	3	1	3	5	—
	Triticum aestivum /durum	weight	caryopsis	0.122	0.05	0.024	0.008	0.017	0.043	—
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	1	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	0.006	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	<0.001	—	—	—	<0.001	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	—	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	—	—	2	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	1	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	1	—	—	—	—	—
	Triticum aestivum	count	rachis segment	—	—	1	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	1	—	—	—	—	2	—
	Pulse indeterminable	weight	seed	0.007	—	—	—	—	0.006	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	—	—
	Lens culinaris	weight	seed	—	—	—	—	—	—	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN18C2870s15	KIN17C2805s16	KIN17C2814s27	KIN17C642s30	KIN17C2825s38	KIN17C2830s40	KIN16C2659s47
			Trench	C3E	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2
			context type	pit fill	pit fill	pit fill	surface	pit fill	pit fill	surface
			soil volume (l)	38	14.5	18	9	8	13	4.25
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	1	—	—	—	—	—	—
	Vicia ervilia	weight	seed	0.006	—	—	—	—	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	1	—	—	—	—	—	—
	Ficus carica	weight	seed	<0.001	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	6	—	2	—	—	—	—
	Vitis vinifera	weight	seed	0.053	—	0.022	—	—	—	—
	Vitis vinifera	count	pedicel	1	—	—	—	—	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	1	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN18C2870s15	KIN17C2805s16	KIN17C2814s27	KIN17C642s30	KIN17C2825s38	KIN17C2830s40	KIN16C2659s47
			Trench	C3E	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2
			context type	pit fill	pit fill	pit fill	surface	pit fill	pit fill	surface
			soil volume (l)	38	14.5	18	9	8	13	4.25
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	2	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	—	4	—	1	—	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	1	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	1	—	—	—	—	2	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	1	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Atriplex sp.	count	bract	—	—	—	—	4	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	5	—	1	—	—	3	—
	Salsola sp.	count	seed	1	—	—	—	—	—	—
	Suaeda sp.	count	seed	6	1	1	—	3	2	—
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	—	—	—	—	4	—
	Cyperaceae s.l.	count	endosperm	4	2	—	1	1	2	—
	Bolboschoenus glaucus	count	achene	2	1	1	—	—	8	1
	Bolboschoenus sp.	count	achene	—	1	1	—	—	—	—
	Carex spp. (flattened)	count	achene	10	5	2	1	2	2	1
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	1	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	1	3	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

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			Trench	C3E	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2
			context type	pit fill	pit fill	pit fill	surface	pit fill	pit fill	surface
			soil volume (l)	38	14.5	18	9	8	13	4.25
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	2	4	—	—	—	4	—
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	2	—	—	—	1	3	—
	Melilotus- type	count	seed	—	—	6	—	—	—	—
	Trifolium- type	count	seed	2	3	3	—	—	5	1
	Trigonella- type	count	seed	2	1	1	—	—	2	—
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	1	2	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	—	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	1	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	1	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	8	—	2	—	—	2	—
	Poaceae s.l.	count	rachis internode	—	—	2	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	—	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	1	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	2	—	—	—	—	—	—
	Polygonaceae s.l.	count	endosperm	1	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	1
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	—	—	—

				KIN18C2870s15	KIN17C2805s16	KIN17C2814s27	KIN17C642s30	KIN17C2825s38	KIN17C2830s40	KIN16C2659s47
			Trench	C3E	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2
			context type	pit fill	pit fill	pit fill	surface	pit fill	pit fill	surface
			soil volume (l)	38	14.5	18	9	8	13	4.25
	Rumex sp.	count	achene	1	—	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	1	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	1	—	—	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /*Asperula*	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /*orientalis*	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	1	—	—	—	—	—	—
Scrophulariaceae	*Scrophularia* /*Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	—	1	—	—	2	—
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	1	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	–	4	2	1	—	—	1	—
	KH-unk1	count	–	—	—	—	—	—	—	—
	KH-unk2	count	–	—	—	—	—	—	—	—
	KH-unk3	count	–	—	—	1	—	—	—	—
	KH-unk4	count	–	—	—	—	—	—	—	—
	KH-unk5	count	–	—	—	—	—	—	—	—
	KH-unk6	count	–	—	—	—	—	—	—	—
	KH-unk7	count	–	—	—	—	—	—	—	—
	KH-unk8	count	–	—	—	—	—	—	—	—
	KH-unk9	count	–	—	—	—	—	—	—	—
	KH-unk10	count	–	—	—	—	—	—	—	—
	KH-unk11	count	–	—	—	—	—	—	—	—
	Indeterminable	count	–	—	—	—	—	1	1	—
	Indeterminable fragments	weight	–	<0.001	<0.001	—	—	<0.001	<0.001	<0.001
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	1.635	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	1
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	1	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	—	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	2	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN18C2870s15	KIN17C2805s16	KIN17C2814s27	KIN17C642s30	KIN17C2825s38	KIN17C2830s40	KIN16C2659s47
			Trench	C3E	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2	C3E.2
			context type	pit fill	pit fill	pit fill	surface	pit fill	pit fill	surface
			soil volume (l)	38	14.5	18	9	8	13	4.25
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	5.162	2.445	1.534	6.121	3.158	2.013	4.864
	Wood charcoal >4mm	weight	wood	1.49	1.96	1.22	6.16	4.65	1.58	4.12
	Amorphous material	weight	unknwon	0.064	0.012	<0.001	—	0.061	0.006	0.032
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	3	1	2	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	19	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	1	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	1	—	—	—	2	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	2	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	1	—	—	—
	Cyperaceae s.l.	count	achene	—	—	2	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	1	—	—	—	—	—	—
	Rumex sp.	count	achene	1	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN16C2672s9999	KIN17C665s63	KIN17C2853s81	KIN18C2870s13	KIN17C2812s22	KIN17C2811s32	KIN17C2812s39
			Trench	C3E	C3E	C3E	C3W	C3W	C3W	C3W
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3W.3	C3W.3	C3W.3	C3W.3
			context type	layer	pit fill	pit fill	pit fill	layer	layer	layer
			soil volume (l)	3.25	15	17	39	28	22	14
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	<0.001	0.079	0.044	0.124	0.058	0.061	0.085
	Cerealia	count	germ	—	—	—	—	—	—	1
Barley	*Hordeum vulgare*	count	caryopsis	—	7	4	7	3	5	6
	Hordeum vulgare	weight	caryopsis	—	0.077	0.05	0.072	0.034	0.024	0.065
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	—	1	—	—	P
	Triticum sp.	weight	caryopsis	—	—	—	<0.001	—	—	0.008
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	4	2	4	3	9	5	3
	Triticum aestivum /durum	weight	caryopsis	0.018	0.008	0.02	0.035	0.069	0.052	0.015
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	3	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	0.012	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	1	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	<0.001	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	2	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	<0.001	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	—	—	<0.001	<0.001	—	—	0.019
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	2	1	1	—	—	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	2	—	1	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	1	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	2.5	—	0.5	—	—	—
	Pulse indeterminable	weight	seed	—	0.012	—	0.005	—	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	1	—	1	—	—	—
	Lens culinaris	weight	seed	—	0.007	—	0.009	—	—	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN16C2672s9999	KIN17C665s63	KIN17C2853s81	KIN18C2870s13	KIN17C2812s22	KIN17C2811s32	KIN17C2812s39
			Trench	C3E	C3E	C3E	C3W	C3W	C3W	C3W
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3W.3	C3W.3	C3W.3	C3W.3
			context type	layer	pit fill	pit fill	pit fill	layer	layer	layer
			soil volume (l)	3.25	15	17	39	28	22	14
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	—	2	—	—	1
	Vicia ervilia	weight	seed	—	—	—	0.028	—	—	0.008
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	P	—	6	1	—	2
	Vitis vinifera	weight	seed	—	0.02	—	0.093	0.014	—	0.02
	Vitis vinifera	count	pedicel	—	4	—	1	—	—	2
	Vitis vinifera	weight	skin fragment	—	0.005	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	1	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	1	1	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	1	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	87	—	11
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	6	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN16C2672s9999	KIN17C665s63	KIN17C2853s81	KIN18C2870s13	KIN17C2812s22	KIN17C2811s32	KIN17C2812s39
			Trench	C3E	C3E	C3E	C3W	C3W	C3W	C3W
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3W.3	C3W.3	C3W.3	C3W.3
			context type	layer	pit fill	pit fill	pit fill	layer	layer	layer
			soil volume (l)	3.25	15	17	39	28	22	14
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	1
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	1	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	2	1	—	1	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	1	—	—	1	1
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	3	1	4	—	3	4
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	1	—	—	—	1	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	1	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	1	—	1	—
	cf *Silene* sp.	count	seed	—	2	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	2	1	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Atriplex sp.	count	bract	—	—	—	—	4	—	—
	Atriplex sp.	count	seed	—	3	—	2	9	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	9	1	7	11	1	—
	Salsola sp.	count	seed	—	3	—	1	1	1	1
	Suaeda sp.	count	seed	—	2	1	1	3	7	2
Cistaceae	*Helianthemum* sp.	count	seed	—	1	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	—	6	3	3	—	3	1
	Cyperaceae s.l.	count	endosperm	—	2	1	1	1	—	—
	Bolboschoenus glaucus	count	achene	—	—	—	—	1	—	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	4	16	5	8	3	—	—
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	2	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	1	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN16C2672s9999	KIN17C665s63	KIN17C2853s81	KIN18C2870s13	KIN17C2812s22	KIN17C2811s32	KIN17C2812s39
			Trench	C3E	C3E	C3E	C3W	C3W	C3W	C3W
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3W.3	C3W.3	C3W.3	C3W.3
			context type	layer	pit fill	pit fill	pit fill	layer	layer	layer
			soil volume (l)	3.25	15	17	39	28	22	14
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	4	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	2	1	—	6	2
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	2	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	1	2	—	2	6	3	3
	Melilotus- type	count	seed	—	3	2	2	—	—	1
	Trifolium- type	count	seed	—	1	2	3	4	5	7
	Trigonella- type	count	seed	—	5	5	6	12	4	9
	Coronilla-type	count	seed	—	—	1	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	1	—	—	—	1	—
	Lallemianta -type	count	nutlet	—	—	—	1	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	1	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	1	—	—	6	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	1	—	1	1
	Glaucium sp.	count	seed	—	—	—	1	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	2	1	1	1	—	2
Poaceae	Poaceae s.l.	count	caryopsis	—	8	—	9	12	1	6
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	1	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	1	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	2	—	—	—	3	1
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	1	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	2	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	1	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	—	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	2	—	—	2	—	1
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	3	1	—	—	1	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	1	—	—	—

				KIN16C2672s9999	KIN17C665s63	KIN17C2853s81	KIN18C2870s13	KIN17C2812s22	KIN17C2811s32	KIN17C2812s39
			Trench	C3E	C3E	C3E	C3W	C3W	C3W	C3W
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3W.3	C3W.3	C3W.3	C3W.3
			context type	layer	pit fill	pit fill	pit fill	layer	layer	layer
			soil volume (l)	3.25	15	17	39	28	22	14
	Rumex sp.	count	achene	—	—	—	—	—	—	1
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	1	1	—	—	1
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	2	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	1	—	1
	Ceratocephalus falcatus	count	achene	—	—	—	—	1	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	1
	Galium sp.	count	fruit	—	3	1	—	—	—	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	1	—	—
	Hyoscyamus sp.	count	seed	—	8	1	2	2	—	1
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	1	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	1	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	2	1	—	5	3	1	1
	KH-unk1	count	—	—	—	—	—	—	—	—
	KH-unk2	count	—	—	—	—	—	—	—	—
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	1	4	1	—	1	—	—
	Indeterminable fragments	weight	—	<0.001	—	<0.001	0.009	0.01	<0.001	<0.001
	Indeterminable nut fragments	weight	endocarp	—	—	0.009	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	2	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	—	—	3	—	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	2	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN16C2672s9999	KIN17C665s63	KIN17C2853s81	KIN18C2870s13	KIN17C2812s22	KIN17C2811s32	KIN17C2812s39
			Trench	C3E	C3E	C3E	C3W	C3W	C3W	C3W
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV
			Phase	C3E.2	C3E.2	C3E.2	C3W.3	C3W.3	C3W.3	C3W.3
			context type	layer	pit fill	pit fill	pit fill	layer	layer	layer
			soil volume (l)	3.25	15	17	39	28	22	14
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	2.036	0.61	1.28	2.819	5.765	1.723	1.968
	Wood charcoal >4mm	weight	wood	0.54	1.861	0.38	1.29	42.89	2.71	2.48
	Amorphous material	weight	unknwon	—	0.039	<0.001	0.018	0.274	0.034	0.055
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	1	3	18	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	1	1	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	1	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	2	—	—	—
	Cyperaceae s.l.	count	achene	—	2	1	2	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	2	—	1	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN17C2833s47	KIN17C2834s51	KIN17C2837s56	KIN17C2838s59	KIN17C2838s61	KIN17C2841s67	KIN14A153s32
			Trench	C3W	C3W	C3W	C3W	C3W	C3W	Aw
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P VA
			Phase	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	Aw.6
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	22.5	25	21.5	nr	18	22	22.15
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	—	P	P	P
	Cerealia	weight	caryopsis	0.066	0.169	0.075	—	0.057	0.058	0.424
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	15	8	5	—	7	8	47
	Hordeum vulgare	weight	caryopsis	0.091	0.084	0.039	—	0.046	0.075	0.62
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	P	—	2	—	P	2	4
	Triticum sp.	weight	caryopsis	0.005	—	<0.001	—	<0.001	0.029	0.027
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	9	9	7	—	10	11	53
	Triticum aestivum /durum	weight	caryopsis	0.048	0.078	0.057	—	0.089	0.079	0.494
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	4
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	0.014
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	5
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	0.005
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.007	0.041	—	—	0.052	—	0.194
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	3	3	—	—	—	1	24
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	4	2	—	2	2	10
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	2
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	1	3	—	—	—	—	4
	Triticum aestivum/durum	count	rachis segment frg	—	4	—	—	—	—	1
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	1
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	—	—	—	—	12
	Triticum aestivum	count	rachis segment	1	—	—	—	—	—	1
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	1	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	P	—	0.5	—	—	—	4
	Pulse indeterminable	weight	seed	0.024	—	0.02	—	—	—	0.032
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	—	2
	Lens culinaris	weight	seed	—	—	—	—	—	—	0.009
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN17C2833s47	KIN17C2834s51	KIN17C2837s56	KIN17C2838s59	KIN17C2838s61	KIN17C2841s67	KIN14A153s32
			Trench	C3W	C3W	C3W	C3W	C3W	C3W	Aw
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P VA
			Phase	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	Aw.6
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	22.5	25	21.5	nr	18	22	22.15
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	1	—	—	—	—	—	15
	Vicia ervilia	weight	seed	0.014	—	—	—	—	—	0.132
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	P	—	16
	Crataegus sp.	weight	pyrene	—	—	—	—	<0.001	—	0.134
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	1
	Rubus sp.	weight	seed	—	—	—	—	—	—	0.001
Grape	*Vitis vinifera*	count	seed	1	2	1	—	—	1	1
	Vitis vinifera	weight	seed	0.005	0.024	0.012	—	—	0.019	0.005
	Vitis vinifera	count	pedicel	—	—	2	—	—	2	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	2	—	1	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	3	222	1591	—	843	3	—
	cf *Artemisia* sp.	count	achene	2	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	1	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	11	—	—	—	—

				KIN17C2833s47	KIN17C2834s51	KIN17C2837s56	KIN17C2838s59	KIN17C2838s61	KIN17C2841s67	KIN14A153s32
			Trench	C3W	C3W	C3W	C3W	C3W	C3W	Aw
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P VA
			Phase	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	Aw.6
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	22.5	25	21.5	nr	18	22	22.15
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	2	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	1	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	1	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	5	3	—	—	—	2	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	9	1	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	3	2	3	—	2	2	1
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	1
	Gypsophila sp.	count	seed	—	1	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	1	—	—	—	1
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	10	—	—	—	3	3	9
	Atriplex sp.	count	bract	—	4	—	—	—	—	—
	Atriplex sp.	count	seed	7	3	5	—	5	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	1	1	7	—	6	2	12
	Salsola sp.	count	seed	—	—	6	—	3	—	—
	Suaeda sp.	count	seed	10	11	6	—	2	—	19
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	2	4	1	—	4	2	5
	Cyperaceae s.l.	count	endosperm	3	1	1	—	2	—	1
	Bolboschoenus glaucus	count	achene	4	3	4	—	2	—	5
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	—	1	—	—	—	—	2
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	1	—	3	—	—	—	5
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN17C2833s47	KIN17C2834s51	KIN17C2837s56	KIN17C2838s59	KIN17C2838s61	KIN17C2841s67	KIN14A153s32
			Trench	C3W	C3W	C3W	C3W	C3W	C3W	Aw
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P VA
			Phase	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	Aw.6
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	22.5	25	21.5	nr	18	22	22.15
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	2
	Trifolieae s.l.	count	seed	4	2	8	—	2	1	2
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	2	1	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	1	—	—
	Medicago- type	count	seed	10	2	7	—	15	1	6
	Melilotus- type	count	seed	1	12	3	—	8	2	—
	Trifolium- type	count	seed	2	2	7	—	2	1	2
	Trigonella- type	count	seed	6	27	23	—	28	9	10
	Coronilla-type	count	seed	—	—	—	—	1	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	2	—	—	—	—	1	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	1	—	—	—	—
	Teucrium -type	count	nutlet	—	1	—	—	—	—	1
	Ziziphora sp.	count	nutlet	1	4	3	—	2	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	1
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	1	—	1	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	5	3	10	—	16	5	9
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	3
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	1	2	2	—	—	—	5
	Eremopyrum sp.	count	caryopsis	—	—	—	—	1	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	1	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	1	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	1	—	1	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	1	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	1	—	—	—	2
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	12
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	1	—	—	—	5
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	—	—	—

				KIN17C2833s47	KIN17C2834s51	KIN17C2837s56	KIN17C2838s59	KIN17C2838s61	KIN17C2841s67	KIN14A153s32
			Trench	C3W	C3W	C3W	C3W	C3W	C3W	Aw
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P VA
			Phase	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	Aw.6
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	22.5	25	21.5	nr	18	22	22.15
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	2	—	2	1	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—	—
	Ceratocephalus falcatus	count	achene	1	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	—	—
	Asperula sp.	count	fruit	1	—	—	—	—	—	—
	Galium sp.	count	fruit	—	1	2	—	1	—	10
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	1	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	1	—
	Hyoscyamus sp.	count	seed	6	1	8	—	1	3	2
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	1	—	1	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	1	2	—	—	4	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	2	2	2	—	1	3	1
	KH-unk1	count	—	—	—	—	—	—	—	—
	KH-unk2	count	—	—	—	—	—	—	—	1
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	1	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	2	2	4	—	3	6	10
	Indeterminable fragments	weight	—	<0.000	—	<0.001	0.01	<0.001	<0.001	0.02
	Indeterminable nut fragments	weight	endocarp	—	<0.001	0.001	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	2	—	1	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	1	2	1	—	7	—	1
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	2	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	<0.001

				KIN17C2833s47	KIN17C2834s51	KIN17C2837s56	KIN17C2838s59	KIN17C2838s61	KIN17C2841s67	KIN14A153s32
			Trench	C3W	C3W	C3W	C3W	C3W	C3W	Aw
			Period	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P IV	KH-P VA
			Phase	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	C3W.3	Aw.6
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	22.5	25	21.5	nr	18	22	22.15
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	4.864	4.878	12.472	3.319	6.215	3.446	12.058
	Wood charcoal >4mm	weight	wood	4.12	3.6	14.78	28.42	6.39	2.46	7.56
	Amorphous material	weight	unknwon	0.075	0.121	0.147	—	0.408	0.055	0.11
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	1	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	1
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN17A1402s4	KIN17A1406s17	KIN17A164s26	KIN17A1410s34	KIN17A164s55	KIN15C2524s15	KIN18C2524s23
			Trench	Aw	Aw	Aw	Aw	Aw	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA
			Phase	Aw.7	Aw.7	Aw.7	Aw.7	Aw.7	C3E.3	C3E.3
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	26.5	20	21	12	21	15	24
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.051	0.095	0.089	0.047	0.58	0.046	0.046
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	8	8	7	2	9	3	6
	Hordeum vulgare	weight	caryopsis	0.061	0.089	0.063	0.017	0.084	0.015	0.04
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	—	1	—	—	—	1
	Triticum sp.	weight	caryopsis	—	—	0.005	—	—	—	0.005
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	9	5	9	7	6	5	3
	Triticum aestivum /durum	weight	caryopsis	0.082	0.037	0.079	0.065	0.044	0.019	0.028
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	—	—	—
	Panicum miliaceum	weight	caryopsis	—	—	—	—	—	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.008	<0.001	<0.001	—	<0.001	0.014	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	2	—	7	—	—	2	—
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	1	—	3	—	—	1	1
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	1	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	2	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	2	1	2	—	—	2	1
	Triticum aestivum/durum	count	rachis segment frg	—	2	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	1	3	—	—	1	—
	Triticum aestivum	count	rachis segment	—	—	1	—	—	1	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	—	—	—	—	—
	Pulse indeterminable	weight	seed	—	—	—	—	—	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	—	—	—	—	—
	Lens culinaris	weight	seed	—	—	—	—	—	—	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN17A1402s4	KIN17A1406s17	KIN17A164s26	KIN17A1410s34	KIN17A164s55	KIN15C2524s15	KIN18C2524s23
			Trench	Aw	Aw	Aw	Aw	Aw	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA
			Phase	Aw.7	Aw.7	Aw.7	Aw.7	Aw.7	C3E.3	C3E.3
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	26.5	20	21	12	21	15	24
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	2	—	—	—	—	—
	Vicia ervilia	weight	seed	—	0.022	—	—	—	—	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	2	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	<0.001	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	—
	Ficus carica	weight	seed	—	—	—	—	—	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	2	P	—	2	1	1
	Vitis vinifera	weight	seed	—	0.026	<0.001	—	0.022	0.012	0.011
	Vitis vinifera	count	pedicel	—	—	2	—	—	1	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	1	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	1	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	2	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	24	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN17A1402s4	KIN17A1406s17	KIN17A164s26	KIN17A1410s34	KIN17A164s55	KIN15C2524s15	KIN18C2524s23
			Trench	Aw	Aw	Aw	Aw	Aw	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA
			Phase	Aw.7	Aw.7	Aw.7	Aw.7	Aw.7	C3E.3	C3E.3
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	26.5	20	21	12	21	15	24
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	2	—	1	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	1	—	—	1	3	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	1	—	—	—	—
	Descurania-type	count	seed	—	—	1	—	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	1	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	12	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	1
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	1	—	—	—	—	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	1	—	—	3	—
	Vaccaria pyramidata	count	seed	1	—	—	—	—	—	2
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	1	3	—	1	2	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	3	—	—	—	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	1	26	6	1	4	4	3
	Salsola sp.	count	seed	—	—	1	—	1	1	1
	Suaeda sp.	count	seed	4	2	4	1	5	3	4
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	1	3	3	—	2	2	2
	Cyperaceae s.l.	count	endosperm	—	—	—	2	—	2	—
	Bolboschoenus glaucus	count	achene	—	—	1	—	—	2	—
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	3	1	—	2	3	4	7
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	2	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	2	—	—	1	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	1	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN17A1402s4	KIN17A1406s17	KIN17A164s26	KIN17A1410s34	KIN17A164s55	KIN15C2524s15	KIN18C2524s23
			Trench	Aw	Aw	Aw	Aw	Aw	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA
			Phase	Aw.7	Aw.7	Aw.7	Aw.7	Aw.7	C3E.3	C3E.3
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	26.5	20	21	12	21	15	24
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	1
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	2	7	6	—	5	6
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	—	5	2	1	—	—	1
	Melilotus- type	count	seed	—	—	9	—	3	—	—
	Trifolium- type	count	seed	3	1	8	1	—	—	—
	Trigonella- type	count	seed	—	3	31	—	2	4	1
	Coronilla-type	count	seed	—	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	5	—	4	1	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	—	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	—	3	—	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	1	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	3	4	9	2	7	7	7
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	1	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	—	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	1	—	2	1	1	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	—	1
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	1	—	—	—	1	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	—	—	—	—

				KIN17A1402s4	KIN17A1406s17	KIN17A164s26	KIN17A1410s34	KIN17A164s55	KIN15C2524s15	KIN18C2524s23
			Trench	Aw	Aw	Aw	Aw	Aw	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA
			Phase	Aw.7	Aw.7	Aw.7	Aw.7	Aw.7	C3E.3	C3E.3
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	26.5	20	21	12	21	15	24
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	1	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	1	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	1	1	—	—	—	—	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	—
	Galium sp.	count	fruit	1	1	—	—	2	1	—
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	4	1	—	2	2	2
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	1	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	2	—	1	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	2	2	4	1	1	—	3
	KH-unk1	count	—	—	—	—	—	—	—	—
	KH-unk2	count	—	—	2	1	—	1	—	—
	KH-unk3	count	—	—	1	—	1	1	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	3	—	3	1	3	3	—
	Indeterminable fragments	weight	—	—	—	0.008	0.007	0.008	0.022	—
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	1	1	—	—	1	—	—
	Thorn	count	thorn	—	—	—	—	1	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	—	—	—	—	—	—

				KIN17A1402s4	KIN17A1406s17	KIN17A164s26	KIN17A1410s34	KIN17A164s55	KIN15C2524s15	KIN18C2524s23
			Trench	Aw	Aw	Aw	Aw	Aw	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA	KH-P VA
			Phase	Aw.7	Aw.7	Aw.7	Aw.7	Aw.7	C3E.3	C3E.3
			context type	layer	layer	layer	layer	layer	layer	layer
			soil volume (l)	26.5	20	21	12	21	15	24
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	1.952	2.907	2.139	1.264	6.938	2.622	2.778
	Wood charcoal >4mm	weight	wood	1.35	2.73	0.94	1.32	8.99	0.99	2.72
	Amorphous material	weight	unknwon	—	—	0.143	0.011	0.01	0.019	0.033
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	1	—	1	—	8	4
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	1	—	—	—
	Brassicaceae s.l.	count	seed	—	1	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	8	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	2	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	14	—	—	—	1	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	—
	Cyperaceae s.l.	count	achene	1	1	—	—	—	—	1
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN17C2845s73	KIN17C2851s76	KIN18C2890s30	KIN18C2892s31	KIN18C2526s28	KIN18C2536s29	KIN18C2897s35
			Trench	C3W	C3W	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P V B	KH-P VB	KH-P VB	KH-P VB	KH-P VB
			Phase	C3W.4	C3W.4	C3E.4	C3E.4	C3E.4	C3E.4	C3E.4
			context type	layer	layer	fire layer	fire layer	layer	layer	layer
			soil volume (l)	16	18	18	10	10	30	30
Cereal grains										
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.06	0.045	0.073	0.005	0.033	0.053	0.096
	Cerealia	count	germ	—	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	10	7	5	5	5	8	11
	Hordeum vulgare	weight	caryopsis	0.101	0.065	0.061	0.045	0.047	0.094	0.095
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	1	1	—	—	—	4	—
	Triticum sp.	weight	caryopsis	0.005	<0.001	—	—	—	0.01	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	8	5	2	1	3	17	10
	Triticum aestivum /durum	weight	caryopsis	0.065	0.034	0.017	0.007	0.029	0.124	0.086
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	—	—	1	2	9
	Panicum miliaceum	weight	caryopsis	—	—	—	—	<0.001	<0.001	0.011
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—	—
Cereal chaff										
Monocots	Culm fragments	weight	culm	0.06	0.017	0.302	0.047	0.2	0.081	—
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	1	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	2	2	4	—	3	—	1
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	4	1	1	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	1	—	—	1	—	1
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	3	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	1	—	—	—	—
	Triticum aestivum	count	rachis segment	2	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—	—
Pulses										
Pulse undif.	Pulse indeterminable	count	seed	—	—	—	0.5	—	—	—
	Pulse indeterminable	weight	seed	—	—	—	0.007	—	—	—
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	1	—	—	—	—	1	—
	Lens culinaris	weight	seed	0.005	—	—	—	—	0.005	—
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—	—

				KIN17C2845s73	KIN17C2851s76	KIN18C2890s30	KIN18C2892s31	KIN18C2526s28	KIN18C2536s29	KIN18C2897s35
			Trench	C3W	C3W	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P V B	KH-P VB	KH-P VB	KH-P VB	KH-P VB
			Phase	C3W.4	C3W.4	C3E.4	C3E.4	C3E.4	C3E.4	C3E.4
			context type	layer	layer	fire layer	fire layer	layer	layer	layer
			soil volume (l)	16	18	18	10	10	30	30
	Vicia faba	weight	seed	—	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	2	—	—	—	—	2	—
	Vicia ervilia	weight	seed	0.011	—	—	—	—	0.017	—
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—	—
Fruits and Nuts										
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	1	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	0.013	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	—	—	—	—	5
	Ficus carica	weight	seed	—	—	—	—	—	—	<0.001
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	2	—	—	—	—	—	—
	Vitis vinifera	weight	seed	0.026	—	—	—	—	—	—
	Vitis vinifera	count	pedicel	—	1	—	—	—	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—	—
Herbs and oilseeds										
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—	—
Wild and weed plants										
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	1	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	1	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	1	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—	—

				KIN17C2845s73	KIN17C2851s76	KIN18C2890s30	KIN18C2892s31	KIN18C2526s28	KIN18C2536s29	KIN18C2897s35
			Trench	C3W	C3W	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P V B	KH-P VB	KH-P VB	KH-P VB	KH-P VB
			Phase	C3W.4	C3W.4	C3E.4	C3E.4	C3E.4	C3E.4	C3E.4
			context type	layer	layer	fire layer	fire layer	layer	layer	layer
			soil volume (l)	16	18	18	10	10	30	30
	Crepis- type	count	achene	—	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	1	—	—	—	—
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	1
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	1	1	—	2	—	1
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—	—
	Camelina-type	count	seed	—	1	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	—	—	1	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	1	1	1	—	3
	cf *Silene* sp.	count	seed	—	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	1	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	4	—	2	2	1	—	—
	Atriplex sp.	count	bract	—	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	—	—	—	—	2	—
	Beta sp.	count	seed	—	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	4	2	3	2	—	3	10
	Salsola sp.	count	seed	1	16	—	—	—	—	—
	Suaeda sp.	count	seed	5	4	2	2	—	2	14
Cistaceae	*Helianthemum* sp.	count	seed	—	1	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	3	—	10	—	—	3	2
	Cyperaceae s.l.	count	endosperm	—	1	2	1	—	—	2
	Bolboschoenus glaucus	count	achene	—	1	—	2	—	2	3
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	—	5	1	2	7	5	5
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	2	—	—	—	—	—	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—	—

				KIN17C2845s73	KIN17C2851s76	KIN18C2890s30	KIN18C2892s31	KIN18C2526s28	KIN18C2536s29	KIN18C2897s35
			Trench	C3W	C3W	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P V B	KH-P VB	KH-P VB	KH-P VB	KH-P VB
			Phase	C3W.4	C3W.4	C3E.4	C3E.4	C3E.4	C3E.4	C3E.4
			context type	layer	layer	fire layer	fire layer	layer	layer	layer
			soil volume (l)	16	18	18	10	10	30	30
	Cephalaria -type	count	achene	—	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—	1
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	—	—
	Fabaceae s.l.	count	pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	8	—	—	1	—	4
	Trifolieae s.l.	count	pod	—	—	—	—	—	—	—
	Astragalus- type	count	seed	—	1	—	—	—	—	—
	Medicago radiata	count	seed	—	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—	—
	Medicago- type	count	seed	2	8	—	—	1	8	7
	Melilotus- type	count	seed	5	1	1	—	—	—	3
	Trifolium- type	count	seed	2	3	5	2	2	6	21
	Trigonella- type	count	seed	3	17	2	3	1	3	5
	Coronilla-type	count	seed	—	—	—	—	1	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	—	1	2	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—	—
	Teucrium -type	count	nutlet	3	2	—	—	—	—	—
	Ziziphora sp.	count	nutlet	1	3	—	—	—	—	4
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	1	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	1	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Poaceae	Poaceae s.l.	count	caryopsis	5	11	4	—	10	6	23
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	—	—
	Poaceae s.l.	count	glume	—	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	1	—	1
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	—	—	—	1	1
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	1	—	—	—	—	—	1
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—	—
	Setaria viridis /*verticillata* -type	count	caryopsis	—	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	—	—	1	—
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	—	—	—	—
	Polygonum sp.	count	achene	—	—	—	—	—	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	—	—	—
	Polygonum aviculare s.l.	count	achene	—	—	—	1	—	—	—

				KIN17C2845s73	KIN17C2851s76	KIN18C2890s30	KIN18C2892s31	KIN18C2526s28	KIN18C2536s29	KIN18C2897s35
			Trench	C3W	C3W	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P V B	KH-P VB	KH-P VB	KH-P VB	KH-P VB
			Phase	C3W.4	C3W.4	C3E.4	C3E.4	C3E.4	C3E.4	C3E.4
			context type	layer	layer	fire layer	fire layer	layer	layer	layer
			soil volume (l)	16	18	18	10	10	30	30
	Rumex sp.	count	achene	—	—	—	—	2	—	1
Portulacaceae	*Portulaca oleracea*	count	seed	1	—	—	—	—	—	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—	1
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	—	—	—	—	—	1	—
	Asperula sp.	count	fruit	—	—	—	—	—	—	1
	Galium sp.	count	fruit	2	—	—	—	—	2	1
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	—	—	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	2	3	4	2	3	5	1
	Solanum sp.	count	seed	—	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	1	—	—	1	—	—	1
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
Unknown and indeterminable										
unknown	unknown	count	—	1	4	2	2	1	3	—
	KH-unk1	count	—	—	—	—	—	—	—	—
	KH-unk2	count	—	—	—	—	—	—	—	3
	KH-unk3	count	—	—	—	—	—	—	—	—
	KH-unk4	count	—	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	—	—	—	—	—
	KH-unk9	count	—	—	—	1	1	—	1	—
	KH-unk10	count	—	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—	—
	Indeterminable	count	—	—	4	3	—	—	6	6
	Indeterminable fragments	weight	—	0.007	<0.001	—	<0.001	<0.001	<0.001	0.007
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—	—
Other plant parts										
–	"awns"	count	unknown	—	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	1	—	—	—	2	—
	Thorn	count	thorn	—	—	—	—	—	—	—
	Pedicel	count	pedicel	—	1	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	1	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	—	0.007	—	—	—	—	—

				KIN17C2845s73	KIN17C2851s76	KIN18C2890s30	KIN18C2892s31	KIN18C2526s28	KIN18C2536s29	KIN18C2897s35
			Trench	C3W	C3W	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VA	KH-P VA	KH-P V B	KH-P VB	KH-P VB	KH-P VB	KH-P VB
			Phase	C3W.4	C3W.4	C3E.4	C3E.4	C3E.4	C3E.4	C3E.4
			context type	layer	layer	fire layer	fire layer	layer	layer	layer
			soil volume (l)	16	18	18	10	10	30	30
Wood charcoal, dung, amorphous										
–	Wood charcoal >2mm	weight	wood	5.33	4.885	11.313	20.995	5.574	18.562	4.929
	Wood charcoal >4mm	weight	wood	1.87	1.6	3.06	56.1	1.99	10.13	2.49
	Amorphous material	weight	unknwon	0.049	0.008	0.006	—	0.245	0.042	0.037
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—	—
Insects										
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	—	—	—	—
	Larvae	count	insect	—	—	—	—	—	—	—
Uncharred remains										
Alismataceae	*Alisma* -type	count	seed	—	—	—	—	—	1	—
Asteraceae	*Chondrilla juncea*	count	achene	1	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	—	—	—	—	1	1
	Echium sp.	count	nutlet	—	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	—	—	—	—
	Chenopodium sp.	count	seed	—	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	—	—	—	—	2
	Cyperaceae s.l.	count	achene	—	—	—	—	—	—	1
	Fimbristylis sp.	count	achene	—	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	—	—	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	—	—	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	—	—
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	—	—	—	—	—	—
unknown	unknown	count	—	—	—	—	—	—	—	—

				KIN17C25536sNR	KIN18C2898s36	KIN18C3402s42	KIN18C3403s43	KIN18C3410s44	KIN18C3411s49
			Trench	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VI	KH-P VI
			Phase	C3E.4	C3E.4	C3E.5	C3E.5	C3E.6	C3E.6
			context type	layer	pit fill	layer	layer	pit fill	layer
			soil volume (l)	4	20	32	49	10	16
Cereal grains									
Cereals undif.	Cerealia	count	caryopsis	P	P	P	P	P	P
	Cerealia	weight	caryopsis	0.005	0.052	0.118	0.241	0.136	0.194
	Cerealia	count	germ	—	—	—	—	—	—
Barley	*Hordeum vulgare*	count	caryopsis	—	5	16	15	5	5
	Hordeum vulgare	weight	caryopsis	—	0.039	0.212	0.213	0.041	0.084
Naked barley	*Hordeum vulgare* var. *nudum*	count	caryopsis	—	—	—	—	—	—
	Hordeum vulgare var. *nudum*	weight	caryopsis	—	—	—	—	—	—
Wheat undif.	*Triticum* sp.	count	caryopsis	—	2	1	—	1	—
	Triticum sp.	weight	caryopsis	—	0.005	<0.001	—	<0.001	—
Free-threshing wheat	*Triticum aestivum /durum*	count	caryopsis	—	6	15	15	6	14
	Triticum aestivum /durum	weight	caryopsis	—	0.044	0.105	0.142	0.039	0.097
Einkorn or Emmer	*Triticum monococcum /dicoccum*	count	caryopsis	—	—	—	—	—	—
	Triticum monococcum /dicoccum	weight	caryopsis	—	—	—	—	—	—
Einkorn	*Triticum monococcum*	count	caryopsis	—	—	—	—	—	—
	Triticum monococcum	weight	caryopsis	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	caryopsis	—	—	—	—	—	—
	Triticum dicoccum	weight	caryopsis	—	—	—	—	—	—
Rye	*Secale cereale*	count	caryopsis	—	—	—	—	—	—
	Secale cereale	weight	caryopsis	—	—	—	—	—	—
Rye or Wheat	*Triticum /Secale*	count	caryopsis	—	—	—	—	—	—
	Triticum /Secale	weight	caryopsis	—	—	—	—	—	—
Millet undif.	*Panicum /Setaria*	count	caryopsis	—	—	—	—	—	—
	Panicum /Setaria	weight	caryopsis	—	—	—	—	—	—
Broomcorn millet	*Panicum miliaceum*	count	caryopsis	—	—	6	10	—	—
	Panicum miliaceum	weight	caryopsis	—	—	<0.001	0.007	—	—
Foxtail millet	*Setaria italica*	count	caryopsis	—	—	—	—	—	—
	Setaria italica	weight	caryopsis	—	—	—	—	—	—
Cereal chaff									
Monocots	Culm fragments	weight	culm	<0.001	—	—	0.027	<0.001	<0.001
Cereals undif.	Cerealia	count	rachis segment frg	—	—	—	—	—	—
	Cerealia	count	rachis basal segment	—	—	—	—	—	—
	Cerealia	count	glume	—	—	—	—	—	—
Barlet undif.	*Hordeum vulgare* – undif.	count	rachis segment frg	—	—	—	3	—	1
2-row barley	*Hordeum vulgare* – distichon	count	rachis segment frg	—	—	—	—	—	—
6-row barley	*Hordeum vulgare* – hexastichon	count	rachis segment frg	—	—	—	—	—	—
Wheat	*Triticum* sp.	count	rachis segment frg	—	—	—	—	—	—
Free-threshing wheat	Triticum aestivum/durum	count	rachis node	—	—	—	2	—	—
	Triticum aestivum/durum	count	rachis segment frg	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis segment	—	—	—	—	—	—
	Triticum aestivum/durum	count	rachis basal segment	—	—	—	—	—	—
Bread wheat	Triticum aestivum	count	rachis segment frg	—	—	—	2	—	—
	Triticum aestivum	count	rachis segment	—	—	—	—	—	—
Macaroni wheat	*Triticum durum*	count	rachis segment	—	—	—	—	—	—
Macaroni wheat (tentative)	*Triticum* cf *durum*	count	rachis segment	—	—	—	—	—	—
Emmer	*Triticum dicoccum*	count	spikelet fork	—	—	—	—	—	—
Emmer (tentative)	*Triticum* cf *dicoccum*	count	glume base	—	—	—	—	—	—
Rye	*Secale cereale*	count	rachis segment frg	—	—	—	—	—	—
Pulses									
Pulse undif.	Pulse indeterminable	count	seed	—	—	—	1	—	2
	Pulse indeterminable	weight	seed	—	—	—	0.007	—	0.019
Chickpea	*Cicer arietinum*	count	seed	—	—	—	—	—	—
	Cicer arietinum	weight	seed	—	—	—	—	—	—
Lentil	*Lens culinaris*	count	seed	—	—	2	3	1	2
	Lens culinaris	weight	seed	—	—	0.005	0.02	<0.001	0.018
Common pea	*Pisum sativum*	count	seed	—	—	—	—	—	—
	Pisum sativum	weight	seed	—	—	—	—	—	—
Broad bean	*Vicia faba*	count	seed	—	—	—	—	—	—

				KIN17C2536sNR	KIN18C2898s36	KIN18C3402s42	KIN18C3403s43	KIN18C3410s44	KIN18C3411s49
			Trench	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VI	KH-P VI
			Phase	C3E.4	C3E.4	C3E.5	C3E.5	C3E.6	C3E.6
			context type	layer	pit fill	layer	layer	pit fill	layer
			soil volume (l)	4	20	32	49	10	16
	Vicia faba	weight	seed	—	—	—	—	—	—
Bitter vetch	*Vicia ervilia*	count	seed	—	—	—	—	1	4
	Vicia ervilia	weight	seed	—	—	—	—	0.022	0.035
Vetch/field pea	*Vicia /Lathyrus*	count	seed	—	—	—	—	—	—
	Vicia /Lathyrus	weight	seed	—	—	—	—	—	—
Fruits and Nuts									
Hawthorn	*Crataegus* sp.	count	pyrene	—	—	—	—	—	—
	Crataegus sp.	weight	pyrene	—	—	—	—	—	—
Russian olive	*Elaeagnus angustifolia*	count	endocarp	—	—	—	—	—	—
	Elaeagnus angustifolia	weight	endocarp	—	—	—	—	—	—
Common fig	*Ficus carica*	count	seed	—	—	1	2	—	—
	Ficus carica	weight	seed	—	—	<0.001	<0.001	—	—
Common fig (tentative)	cf *Ficus carica*	count	seed	—	—	—	—	—	—
	cf *Ficus carica*	weight	seed	—	—	—	—	—	—
Walnut	*Juglans regia*	count	endocarp	—	—	—	—	—	—
	Juglans regia	weight	endocarp	—	—	—	—	—	—
Walnut (tentative)	cf *Juglans regia*	count	endocarp	—	—	—	—	—	—
	cf *Juglans regia*	weight	endocarp	—	—	—	—	—	—
Apple or pear	*Pyrus /Malus*	count	seed	—	—	—	—	—	—
	Pyrus /Malus	weight	seed	—	—	—	—	—	—
Plum genus	*Prunus* sp.	count	seed	—	—	—	—	—	—
	Prunus sp.	weight	seed	—	—	—	—	—	—
Oak (tentative)	cf *Quercus* sp.	count	cupule	—	—	—	—	—	—
	cf *Quercus* sp.	weight	cupule	—	—	—	—	—	—
Brambles	*Rubus* sp.	count	seed	—	—	—	—	—	—
	Rubus sp.	weight	seed	—	—	—	—	—	—
Grape	*Vitis vinifera*	count	seed	—	—	—	—	—	—
	Vitis vinifera	weight	seed	—	—	—	—	—	—
	Vitis vinifera	count	pedicel	—	—	—	—	—	—
	Vitis vinifera	weight	skin fragment	—	—	—	—	—	—
	Vitis vinifera	count	berry	—	—	—	—	—	—
	Vitis vinifera	count	tendril	—	—	—	—	—	—
Herbs and oilseeds									
Coriander	*Coriandrum sativum*	count	schizocarp	—	—	—	—	—	—
	Coriandrum sativum	weight	schizocarp	—	—	—	—	—	—
Linseed	*Linum usitatissumum*	count	seed	—	—	—	—	—	—
	Linum usitatissumum	weight	seed	—	—	—	—	—	—
Flax (genus)	*Linum* sp.	count	seed	—	—	—	—	—	—
	Linum sp.	weight	seed	—	—	—	—	—	—
Wild and weed plants									
Alismataceae	*Alisma* sp.	count	seed	—	—	—	—	—	—
Apiaceae	Apiaceae s.l.	count	schizocarp	—	—	—	—	—	—
	Apium -type	count	schizocarp	—	—	—	—	—	—
	Bifora radians	count	schizocarp	—	—	—	—	—	—
	Bupleurum -type	count	schizocarp	—	—	—	—	—	—
	Torilis sp.	count	schizocarp	—	—	—	—	—	—
Asteraceae	Asteraceae s.l.	count	achene	—	—	—	—	—	—
	Asteraceae s.l.	count	capitulum	—	—	—	—	—	—
	cf Asteraceae s.l.	count	achene	—	—	—	—	—	—
	Artemisia sp.	count	achene	—	—	—	—	—	—
	Artemisia sp. - large capitulum	count	capitulum	—	—	—	—	—	—
	Artemisia sp. - small capitulum	count	capitulum	—	—	—	—	—	—
	cf *Artemisia* sp.	count	achene	—	—	—	—	—	—
	Aster-type	count	achene	—	—	—	—	—	—
	cf *Aster-type*	count	achene	—	—	—	—	—	—
	Calendula sp.	count	achene	—	—	—	—	—	—
	Carduus nutans-type	count	achene	—	—	—	—	—	—
	Centaurea sp.	count	achene	—	—	—	—	—	—
	Cichorium sp.	count	achene	—	—	—	—	—	—

				KIN17C2536sNR	KIN18C2898s36	KIN18C3402s42	KIN18C3403s43	KIN18C3410s44	KIN18C3411s49
			Trench	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VI	KH-P VI
			Phase	C3E.4	C3E.4	C3E.5	C3E.5	C3E.6	C3E.6
			context type	layer	pit fill	layer	layer	pit fill	layer
			soil volume (l)	4	20	32	49	10	16
	Crepis- type	count	achene	—	—	—	—	—	—
	Onopordum sp.	count	achene	—	—	—	—	—	—
	Scorzonera sp.	count	achene	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—
	Boraginaceae s.l.	count	endosperm	—	—	—	—	—	—
	Buglossoides tenuiflora	count	nutlet	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	2	1	—	—	1
	Echium sp.	count	nutlet	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	1	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—
	Symphytum- type	count	nutlet	—	—	—	—	—	—
Brassicaceae	Brassicaceae s.l.	count	seed	—	—	7	2	—	—
	Brassicaceae s.l.	count	silique	—	—	—	—	—	—
	Alyssum- type	count	seed	—	—	—	—	—	—
	Alyssum /Lepidium	count	seed	—	—	—	—	—	—
	Brassica- type	count	seed	—	—	—	—	—	—
	cf *Brassica* -type	count	seed	—	—	—	—	—	—
	Camelina-type	count	seed	—	—	—	—	—	—
	Cardaria draba	count	seed	—	—	—	—	—	—
	Conringia-type	count	seed	—	—	—	—	—	—
	Descurania-type	count	seed	—	—	2	—	—	—
	Euclidum syriacum	count	silicle	—	—	—	—	—	—
	Lepidium sp.	count	seed	—	—	—	—	—	—
	Lepidium sp.	count	silicle	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—
	Neslia paniculata	count	silicle	—	—	—	—	—	—
Caryophyllaceae	Caryophillaceae s.l.	count	seed	—	—	—	—	—	—
	Buffonia sp.	count	seed	—	—	—	—	—	—
	Silene /Stellaria	count	seed	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	1	—	—
	cf *Silene* sp.	count	seed	—	—	—	—	—	—
	Gypsophila sp.	count	seed	—	—	1	—	—	—
	Vaccaria pyramidata	count	seed	—	1	—	2	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	1	—	5	1	3
	Atriplex sp.	count	bract	—	—	—	—	—	—
	Atriplex sp.	count	seed	—	2	5	3	—	—
	Beta sp.	count	seed	—	—	—	—	—	—
	Chenopodium murale- type	count	seed	—	—	1	—	—	—
	Chenopodium sp.	count	seed	—	—	6	3	6	1
	Salsola sp.	count	seed	—	—	1	1	—	1
	Suaeda sp.	count	seed	2	4	7	7	6	11
Cistaceae	*Helianthemum* sp.	count	seed	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—
Cupressaceae	*Juniperus* sp.	count	leaf	—	—	—	—	—	—
Cyperaceae	Cyperaceae s.l.	count	achene	1	1	7	5	—	2
	Cyperaceae s.l.	count	endosperm	—	—	2	1	—	—
	Bolboschoenus glaucus	count	achene	1	—	4	2	3	1
	Bolboschoenus sp.	count	achene	—	—	—	—	—	—
	Carex spp. (flattened)	count	achene	1	1	13	11	—	—
	Carex spp. (trigonous)	count	achene	—	—	—	—	—	—
	Cyperus sp.	count	achene	—	—	—	—	—	—
	Cyperus longus- type	count	achene	—	—	—	—	—	—
	Eleocharis sp.-type 1	count	achene	—	—	—	—	—	—
	Eleocharis sp.-type 2	count	achene	—	—	—	—	—	—
	Fimbristylis sp.	count	achene	—	—	—	—	—	—
	Scirpoides holoschoenus	count	achene	—	—	—	—	—	—
–	Cyperaceae/Polygonaceae	count	achene	—	—	—	3	1	—
	Cyperaceae/Polygonaceae	count	endosperm	—	—	—	—	—	—
Dipsacaceae	*Dipsacus /Cephalaria*	count	achene	—	—	—	—	—	—
	Dipsacus -type	count	achene	—	—	—	—	—	—

				KIN17C2536sNR	KIN18C2898s36	KIN18C3402s42	KIN18C3403s43	KIN18C3410s44	KIN18C3411s49
			Trench	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VI	KH-P VI
			Phase	C3E.4	C3E.4	C3E.5	C3E.5	C3E.6	C3E.6
			context type	layer	pit fill	layer	layer	pit fill	layer
			soil volume (l)	4	20	32	49	10	16
	Cephalaria -type	count	achene	—	—	—	—	—	—
	Scabiosa sp.	count	achene	—	—	—	—	—	—
Euphorbiaceae	*Euphorbia falcata*- type	count	seed	—	—	—	—	—	—
	Euphorbia taurinensis -type	count	seed	—	—	—	—	—	—
Fabaceae	Fabaceae s.l.	count	seed	—	—	—	—	—	2
	Fabaceae s.l.	count	pod	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	3	—	—	2
	Trifolieae s.l.	count	pod	—	—	—	—	—	—
	Astragalus- type	count	seed	—	—	2	2	—	1
	Medicago radiata	count	seed	—	—	—	—	—	—
	Medicago sp.	count	pod	—	—	—	—	—	—
	Medicago- type	count	seed	—	2	6	9	2	—
	Melilotus- type	count	seed	—	2	2	2	—	3
	Trifolium- type	count	seed	1	8	14	13	1	—
	Trigonella- type	count	seed	—	3	5	9	2	—
	Coronilla-type	count	seed	—	—	—	—	—	—
Lamiaceae	Lamiaceae s.l.	count	nutlet	—	—	—	1	—	—
	Ajuga chamaepitys	count	nutlet	—	—	—	—	—	—
	Ajuga- type	count	nutlet	—	—	1	—	—	—
	Lallemianta -type	count	nutlet	—	—	—	—	—	—
	Menta sp.	count	nutlet	—	—	—	—	—	—
	Nepeta sp.	count	nutlet	—	—	—	—	—	—
	cf *Nepeta* sp.	count	nutlet	—	—	—	—	—	—
	Stachys- type	count	nutlet	—	—	—	—	—	—
	Teucrium -type	count	nutlet	—	—	—	—	—	—
	Ziziphora sp.	count	nutlet	—	—	1	2	—	—
Liliaceae	Liliaceae s.l.	count	seed	—	—	—	—	—	—
	Allium -type	count	bulbile	—	—	—	—	—	—
	Bellevalia sp.	count	seed	—	—	—	—	—	—
	Ornithogalum sp.	count	seed	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—
Papaveraceae	*Fumaria* sp.	count	fruit	—	—	—	—	—	—
	Glaucium sp.	count	seed	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	1	—	—	—
Pinaceae	*Abies* sp.	count	needle	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	1	—	—	1	—	—
Poaceae	Poaceae s.l.	count	caryopsis	—	12	39	16	7	3
	Poaceae s.l.	count	rachis internode	—	—	—	—	—	1
	Poaceae s.l.	count	glume	—	—	—	—	—	—
	Poaceae s.l.	count	awn	—	—	—	—	—	—
	Aegilops sp.	count	caryopsis	—	—	—	—	—	—
	Aegilops sp.	count	glume base	—	—	—	—	—	—
	Bromus sp.	count	caryopsis	—	—	—	—	—	—
	Eremopyrum sp.	count	caryopsis	—	—	—	—	—	—
	Festuca- type	count	caryopsis	—	—	—	—	—	—
	Hordeum sp. (wild)	count	caryopsis	—	—	1	—	—	—
	Hordeum sp. (wild)	count	rachis internode	—	—	—	—	—	—
	Lolium sp.	count	caryopsis	—	—	—	—	—	—
	Micropyrum -type	count	caryopsis	—	—	—	—	—	—
	Phalaris sp.	count	caryopsis	—	—	—	—	—	—
	Poa bulbosa	count	floret	—	—	—	—	—	—
	Setaria viridis /verticillata -type	count	caryopsis	—	—	—	—	—	—
	Stipa sp.	count	caryopsis	—	—	—	1	—	1
	Taeniatherum caput-medusae	count	glume base	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—
	Polygonaceae s.l.	count	endosperm	—	—	—	—	—	—
	Persicaria -type	count	achene	—	—	—	1	—	—
	Polygonum sp.	count	achene	—	—	—	2	—	—
	Polygonum convolvulus	count	achene	—	—	—	—	1	—
	Polygonum aviculare s.l.	count	achene	—	1	—	—	—	—

				KIN17C2536sNR	KIN18C2898s36	KIN18C3402s42	KIN18C3403s43	KIN18C3410s44	KIN18C3411s49
			Trench	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VI	KH-P VI
			Phase	C3E.4	C3E.4	C3E.5	C3E.5	C3E.6	C3E.6
			context type	layer	pit fill	layer	layer	pit fill	layer
			soil volume (l)	4	20	32	49	10	16
	Rumex sp.	count	achene	1	—	—	—	—	—
Portulacaceae	*Portulaca oleracea*	count	seed	—	—	—	—	1	—
Potamogetonaceae	*Potamogeton* sp.	count	fruit	—	—	—	—	—	—
Primulaceae	*Androsace maxima*	count	seed	—	—	—	—	—	—
	cf *Androsace* sp.	count	seed	—	—	—	—	—	—
Ranunculaceae	*Adonis* sp.	count	achene	—	—	—	—	—	—
	Ceratocephalus falcatus	count	achene	—	—	—	—	—	—
	Ranunculus sp.	count	achene	—	—	—	—	—	—
Resedaceae	*Reseda lutea* -type	count	seed	—	—	—	—	—	—
Rosaceae	*Sanguisorba* sp.	count	fruit	—	—	—	—	—	—
Rubiaceae	Rubiaceae-type 1	count	fruit	—	—	—	—	—	—
	Galium /Asperula	count	fruit	—	—	—	—	—	—
	Asperula arvensis /orientalis	count	fruit	1	—	—	2	1	1
	Asperula sp.	count	fruit	—	—	—	1	—	—
	Galium sp.	count	fruit	—	—	—	2	1	2
Scrophulariaceae	*Scrophularia /Verbascum*	count	seed	—	—	—	1	—	—
	Veronica sp.	count	seed	—	—	—	—	—	—
	Veronica dillenii-type	count	seed	—	—	—	—	—	—
	Veronica hederifolia	count	seed	—	—	—	—	—	—
	Veronica polita -type	count	seed	—	—	—	—	—	—
	Veronica triphyllos	count	seed	—	—	—	—	—	—
Solanaceae	Solanaceae s.l.	count	seed	—	—	—	—	—	—
	Hyoscyamus sp.	count	seed	—	1	5	1	1	1
	Solanum sp.	count	seed	—	—	—	—	—	—
Thymelaeaceae	*Thymelaea* sp.	count	achene	—	—	—	—	—	—
Valerianaceae	*Valerianella coronata*- type	count	achene	—	—	—	—	—	—
	Valerianella vesicaria- type	count	achene	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—
Unknown and indeterminable									
unknown	unknown	count	—	—	—	4	3	1	2
	KH-unk1	count	—	—	—	—	—	—	—
	KH-unk2	count	—	—	1	9	9	—	—
	KH-unk3	count	—	—	—	—	—	1	—
	KH-unk4	count	—	—	—	—	—	—	—
	KH-unk5	count	—	—	—	—	—	—	—
	KH-unk6	count	—	—	—	—	—	—	—
	KH-unk7	count	—	—	—	—	—	—	—
	KH-unk8	count	—	—	—	1	1	—	—
	KH-unk9	count	—	—	—	—	—	—	—
	KH-unk10	count	—	—	—	—	—	—	—
	KH-unk11	count	—	—	—	—	—	—	—
	Indeterminable	count	—	1	2	19	9	—	5
	Indeterminable fragments	weight	—	<0.001	—	—	—	0.005	—
	Indeterminable nut fragments	weight	endocarp	—	—	—	—	—	—
	Seed clots	weight	seed	—	—	—	—	—	—
Other plant parts									
–	"awns"	count	unknown	—	—	—	—	—	—
	Bark fragment	count	bark	—	—	—	—	—	—
	Bud	count	bud	—	—	—	—	—	—
	Calyx	count	calyx	—	—	—	—	—	—
	Leaf fragment	count	leaf	—	—	—	—	—	—
	Root	count	root	—	—	—	—	—	—
	Root	weight	root	—	—	—	—	—	—
	Sclerotia	count	sclerotia	—	—	8	5	—	—
	Thorn	count	thorn	—	—	—	—	—	—
	Pedicel	count	pedicel	—	—	—	—	—	—
	Capsule	count	capsule	—	—	—	—	—	—
	Unknown plant part (countable)	count	unknown	—	—	—	—	—	—
	Unknown plant part (uncountable)	weight	unknown	0.011	—	—	—	—	—

				KIN17C2536sNR	KIN18C2898s36	KIN18C3402s42	KIN18C3403s43	KIN18C3410s44	KIN18C3411s49
			Trench	C3E	C3E	C3E	C3E	C3E	C3E
			Period	KH-P VB	KH-P VB	KH-P VB	KH-P VB	KH-P VI	KH-P VI
			Phase	C3E.4	C3E.4	C3E.5	C3E.5	C3E.6	C3E.6
			context type	layer	pit fill	layer	layer	pit fill	layer
			soil volume (l)	4	20	32	49	10	16
Wood charcoal, dung, amorphous									
–	Wood charcoal >2mm	weight	wood	2.385	3.243	7.219	17.78	2.801	9.633
	Wood charcoal >4mm	weight	wood	0.81	1.13	6.14	11.3	1.14	2.46
	Amorphous material	weight	unknwon	0.005	0.013	0.029	0.025	<0.001	0.025
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—
	Dung - sheep and goat pellet	weight	dung	—	—	—	—	—	—
	Dung	weight	dung	—	—	—	—	—	—
	Rodens droppings	weight	drops	—	—	—	—	—	—
Insects									
Curculionidae	Sitophilus granarius	count	insect	—	—	—	—	—	—
unknown	Insect	count	insect	—	—	—	—	—	—
	Insect fragment	count	insect	—	—	—	1	—	—
	Larvae	count	insect	—	—	—	—	—	—
Uncharred remains									
Alismataceae	*Alisma* -type	count	seed	—	—	1	1	—	—
Asteraceae	*Chondrilla juncea*	count	achene	—	—	—	—	—	—
Boraginaceae	Boraginaceae s.l.	count	nutlet	—	—	—	—	—	—
	Buglossoides arv. /Arnebia dec.	count	nutlet	—	1	2	4	1	1
	Echium sp.	count	nutlet	—	—	—	—	—	—
	Heliotropium sp.	count	nutlet	—	—	—	—	—	—
	Onosma sp.	count	nutlet	—	—	—	—	—	—
Brassicaceae	*Alyssum* sp.	count	seed	—	—	—	—	—	—
	Brassicaceae s.l.	count	seed	—	—	—	—	—	—
	Lepidium perfoliatum	count	seed	—	—	—	—	—	—
Caryophyllaceae	*Gypsophila* sp.	count	seed	—	—	—	—	—	—
	Holosteum umbellatum	count	seed	—	—	—	—	—	—
	Silene sp.	count	seed	—	—	—	—	—	—
	Vaccaria pyramidata	count	seed	—	—	—	—	—	—
Chenopodiaceae	Chenopodiaceae s.l.	count	seed	—	—	—	1	—	1
	Chenopodium sp.	count	seed	—	—	—	—	—	—
	Suaeda sp.	count	seed	—	—	—	—	—	—
Convolvulaceae	*Convolvulus* sp.	count	seed	—	—	—	—	—	—
Cyperaceae	*Carex* sp.	count	achene	—	—	15	5	—	—
	Cyperaceae s.l.	count	achene	—	—	2	—	1	1
	Fimbristylis sp.	count	achene	—	—	—	—	—	—
Fabaceae	*Onobrychis* sp.	count	seed and pod	—	—	—	—	—	—
	Trifolieae s.l.	count	seed	—	—	—	—	—	—
	Trigonella type	count	seed	—	—	—	—	—	—
Malvaceae	*Malva* sp.	count	seed	—	—	—	—	—	—
	Ficus sp.	count	seed	—	—	2	—	—	—
Papaveraceae	*Glaucium* sp.	count	seed	—	—	—	—	—	—
	Papaver sp.	count	seed	—	—	—	—	—	—
Plantaginaceae	*Plantago* sp.	count	seed	—	—	—	—	—	—
Polygonaceae	Polygonaceae s.l.	count	achene	—	—	—	—	—	—
	Rumex sp.	count	achene	—	—	—	—	—	—
Rubiaceae	*Galium* sp.	count	fruit	—	—	—	—	—	—
Scrophulariaceae	*Veronica triphyllos*	count	seed	—	—	1	—	—	—
Solanaceae	*Hyoscyamus* sp.	count	seed	—	—	—	—	—	—
Ulmaceae	*Celtis* sp.	count	endocarp	—	—	—	—	—	3
Vitaceae	*Vitis vinifera*	count	seed	—	—	—	—	—	—
Zygophillaceae	*Peganum harmala*	count	seed	—	—	—	—	—	—
	Tribulus terrestris	count	fruit	—	1	—	—	—	1
unknown	unknown	count	—	—	—	4	—	—	1

APPENDIX 8

Measurements of carpological specimens of selected taxa from Niğde-Kınık Höyük samples

In this appendix I provide the sample-by-sample measurements of: (*i*) whole grains of *Triticum* spp., *Hordeum vulgare*, *Secale cereale*; (*ii*) rachis internode of *Triticum aestivum* and *Triticum aestivum/durum*; and (*iii*) *Vitis vinifera* seeds.

Triticum aestivum/durum – rachis internode ______ 1024

Triticum spp. – grains ______ 1026

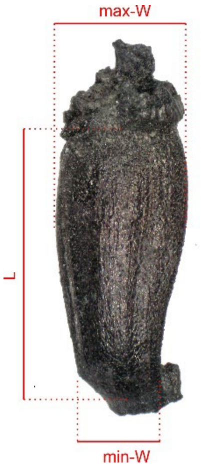
Hordeum vulgare – grains ______ 1047

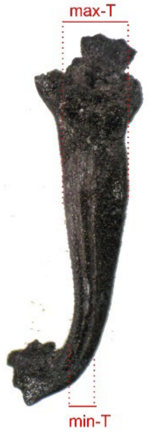
Secale cereale – grains ______ 1060

Vitis vinifera – seeds ______ 1061

***Triticum aestivum /durum* rachis internode**

Period		shape	pad	striations	L	min-W	max-W	min-T	max-T
KH-P I	KIN12B522s96 *T. aestivum* internode	ST	low	present	2.9	1.3	1.9	0.3	0.8
KH-P I	KIN12B522s96 *T. aestivum* internode	SH	low	present	3	1.8	2.4	0.4	1
KH-P I	KIN12B522s96 *T. aestivum* internode	SH	low	present	4.9	1.2	2	0.3	1.1
KH-P I	KIN14B855s4 *T. aestivum* internode	ST	low	—	2	1.5	1.6	0.8	0.8
KH-P II	KIN13B767s126 *T. aestivum* internode	SH	low	present	2.2	0.4	0.85	0.2	0.6
KH-P II	KIN14B2031s133 *T. aestivum* internode	SH	low	present	3.7	1.4	2.3	0.3	0.4
KH-P II	KIN15B2098s77 *T. aestivum* internode	SH	low	present	2.6	1.3	1.7	0.7	0.3
KH-P II	KIN16B2196s59 *T. aestivum* internode	SH	low	present	3.2	1.6	2.2	0.8	0.3
KH-P II	KIN16B2196s59 *T. aestivum* internode	SH	low	present	3.8	1	1.8	0.6	0.2
KH-P II	KIN15B2111s116 *T. aestivum* internode	ST	low	present	3.5	1.4	1.8	0.2	0.4
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	4	1.5	2.1	0.3	0.9
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	2.8	1.3	2	0.3	1
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	3	1.2	1.9	0.5	0.8
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	3.5	1.5	2.4	0.4	0.9
KH-P II	KIN15B2111s116 *T. aestivum/durum* intern.	ST	low	absent	3	1.2	1.8	0.6	1
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	3.2	1.2	1.7	0.3	0.7
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	3	1	1.5	0.2	0.7
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	3	1.1	1.9	0.3	0.9
KH-P II	KIN15B2111s116 *T. aestivum* internode	ST	low	present	4	1	1.5	0.2	0.7
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	3	1.1	1.8	0.3	0.8
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH		present	2.9	0.8	1.4	0.2	0.7
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	2	1.3	1.7	0.6	0.8
KH-P II	KIN15B2111s116 *T. aestivum* internode	SH	low	present	3.2	1.3	2	0.3	0.6
KH-P II	KIN13A939s257 *T. aestivum* internode	ST	high	present	2.7	1.2	1.6	0.6	0.9
KH-P II	KIN13A939s257 *T. aestivum* internode	SH	low	present	2.8	1.2	1.7	0.3	0.8
KH-P II	KIN13A939s257 *T. aestivum* internode	ST	low	present	3	1.5	1.9	0.5	1
KH-P II	KIN13A972s304 *T. aestivum* internode	SH	low	present	1.7	1	1.4	0.3	0.7



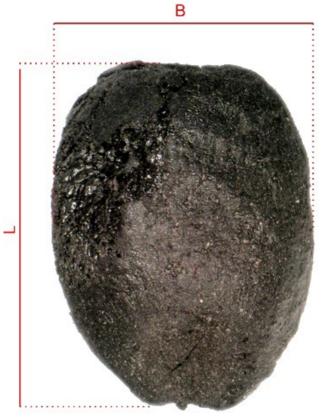


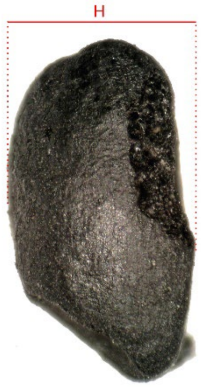
KH-P II	KIN12A237s238 *T. aestivum* internode	SH	low	present	2.8	1.4	1.9	0.4	0.9
KH-P III	KIN17A1790s135 *T. aestivum* internode	ST	low	present	4	1.6	2.3	0.25	1.1
KH-P III	KIN18A1904s4 *T. aestivum* internode	SH	low	absent	3.5	0.9	1.6	0.25	0.6
KH-P III	KIN18A1904s4 *T. aestivum* internode	SH	low	absent	3.8	1	1.9	0.3	0.6
KH-P III	KIN18A1904s4 *T. aestivum* internode	SH	low	absent	2	1	1.5	0.6	0.6
KH-P III	KIN17A1894s157 *T. aestivum* internode	SH	low	absent	5	1	2	0.3	1.3
KH-P III	KIN17A1894s157 *T. aestivum* internode	SH	low	absent	4.7	1.7	2.5	0.3	1
KH-P III	KIN16A11745s95 *T. aestivum* internode	SH	high	present	3.5	1.2	1.7	0.4	0.8
KH-P III	KIN17A1893s149 *T. aestivum* internode	ST	low	present	3	2.5	3.5	0.3	0.7
KH-P III	KIN14B807s125 *T. aestivum* internode	SH	low	present	3.6	1	1.9	0.3	0.9
KH-P III	KIN14B807s125 *T. aestivum* internode	SH	low	present	4.2	1.2	2	0.4	0.6
KH-P III	KIN14B807s125 *T. aestivum/durum* basal	ST	high	absent	2.5-2.8	1.2	1.6	0.5	1
KH-P III	KIN14B807s125 *T. aestivum/durum* basal	SH	low	present	3.0-2.5	1.1	1.5	0.6	1
KH-P III	KIN13B802s162 *T. aestivum* internode	SH	low	present	3	1.3	1.9	0.4	0.8
KH-P IV	kIN17C2833s47 *T. aestivum* internode	SH	low	present	3.6	2.1	1.2	1	0.2
KH-P IV	KIN17C2814s27 *T. aestivum* internode	SH	low	present	3.1	1.3	2	0.2	0.7
KH-P IV	KIN18A178s165 *T. aestivum* internode	SH	low	present	4.1	1.2	2	0.3	0.6
KH-P IV	KIN18A178s165 *T. aestivum* internode	SH	low	present	3.6	1.1	1.5	0.3	0.7
KH-P IV	KIN17A1878s165 *T. aestivum* internode	SH	low	present	3	1.1	1.8	0.1	0.6
KH-P IV	KIN12A291s313 *T. aestivum* internode	SH	low	absent	2.3	1.3	1.8	0.2	0.5
KH-P IV	KIN12A291s313 *T. aestivum* internode	SH	low	absent	2.3	1	1.6	0.2	0.6
KH-P VA	KIN17C2524s15 *T. aestivum* internode	SH	low	absent	3.4	1.4	1.9	0.4	0.9
KH-P VA	KIN17A164s26 *T. aestivum* internode	SH	low	absent	3.6	1.4	2	0.2	0.9
KH-P VA	KIN14A153S32 *T. aestivum* internode	SH	low	present	3.2	1.8	1.2	0.3	0.7
KH-P VA	KIN17C2845s73 *T. aestivum* internode	SH	low	present	4.7	1.4	2	0.3	0.9

Rachis shape: SH = shield-shaped; ST = straight

Triticum **caryopsis**

Period	Sample	ID	L	B	H
KH-P I	KIN15B2082s42	*Triticum aestivum /durum*	4.1	3	2.6
KH-P I	KIN15B2082s42	*Triticum aestivum /durum*	5	3	2.3
KH-P I	KIN15B2082s42	*Triticum aestivum /durum*	3.1	2	1.8
KH-P I	KIN15B2082s42	*Triticum aestivum /durum*	4.8	3.3	2.5
KH-P I	KIN13B617s26	*Triticum* sp.	4.2	2.4	2
KH-P I	KIN13B617s26	*Triticum* sp.	3.5	1.9	1.7
KH-P I	KIN13B617s26	*Triticum* sp.	4	2.2	1.8
KH-P I	KIN13B617s26	*Triticum dicoccum*	4.8	2	2
KH-P I	KIN14B870s23	*Triticum aestivum /durum*	4.4	2.9	2
KH-P I	KIN13B633s45	*Triticum aestivum /durum*	4	2.9	2.5
KH-P I	KIN13B633s45	*Triticum aestivum /durum*	4.6	2.8	2.1
KH-P I	KIN13B633s45	*Triticum aestivum /durum*	4	3	2.4
KH-P I	KIN13B608s39	*Triticum aestivum /durum*	4.7	3.8	2.8
KH-P I	KIN13B608s39	*Triticum aestivum /durum*	4.2	3.2	2.4
KH-P I	KIN13B608s39	*Triticum aestivum /durum*	3.2	2	1.5
KH-P I	KIN13B608s39	*Triticum aestivum /durum*	5	2.6	1.7
KH-P I	KIN15B860s15	*Triticum aestivum /durum*	4.7	3.3	nr
KH-P I	KIN15B860s15	*Triticum aestivum /durum*	4.8	3	2.5
KH-P I	KIN15B860s15	*Triticum aestivum /durum*	5.2	3.5	nr
KH-P I	KIN12B488s18	*Triticum aestivum /durum*	4.8	3.4	3
KH-P I	KIN16B502s13	*Triticum aestivum /durum*	4.3	2.9	2.5
KH-P I	KIN16B2169s11	*Triticum aestivum /durum*	4.7	3.1	2
KH-P I	KIN16B2169s11	*Triticum aestivum /durum*	5	3.4	2.7
KH-P I	KIN16B2169s11	*Triticum aestivum /durum*	4.5	2.9	2
KH-P I	KIN16B2169s11	*Triticum aestivum /durum*	4.2	3	2
KH-P I	KIN16B2169s11	*Triticum aestivum /durum*	4.8	3.6	2.8
KH-P I	KIN16B2169s11	*Triticum aestivum /durum*	3.5	2.5	2
KH-P I	KIN14B855s4	*Triticum aestivum /durum*	4.3	2.8	2.2
KH-P I	KIN13B636s53	*Triticum aestivum /durum*	5.5	3.3	2.5
KH-P I	KIN13B636s53	*Triticum aestivum /durum*	4.8	3	2.8
KH-P I	KIN13B644s67	*Triticum aestivum /durum*	5	3.7	2.3
KH-P I	KIN13B644s67	*Triticum aestivum /durum*	4	2.8	2.4
KH-P I	KIN13B644s67	*Triticum aestivum /durum*	4	3.2	2.2
KH-P I	KIN13B644s67	*Triticum aestivum /durum*	5	3.3	2.6
KH-P I	KIN14B895s78	*Triticum aestivum /durum*	3.5	2.5	1.9
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	4.7	3.5	2.5
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	5	3.2	2
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	4.6	3.2	2.2
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	5	3.3	2.8
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	5	3.3	nr
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	4.6	3.1	2
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	5	2.8	2.4
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	4.8	3.5	2.2
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	4.6	2.6	1.8
KH-P I	KIN12B522s96	*Triticum aestivum /durum*	5.7	3	2.4
KH-P I	KIN13B762s122	*Triticum aestivum /durum*	4.2	3.1	2.5
KH-P I	KIN13B762s122	*Triticum aestivum /durum*	4.6	3.1	2.2
KH-P I	KIN13B762s122	*Triticum aestivum /durum*	4.2	2.9	2.3
KH-P I	KIN13B762s122	*Triticum aestivum /durum*	4.8	3.6	3.1
KH-P I	KIN13B762s122	*Triticum aestivum /durum*	3.7	2.5	2





Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P I	KIN13B762s122	*Triticum aestivum /durum*	4	3.2	2.7
KH-P I	KIN12B534s123	*Triticum aestivum /durum*	4.3	3	2.3
KH-P I	KIN12B534s123	*Triticum aestivum /durum*	3.8	2.3	2
KH-P I	KIN12B534s123	*Triticum aestivum /durum*	3.7	2.9	nr
KH-P I	KIN12B562s158	*Triticum aestivum /durum*	3.6	3.3	2.5
KH-P I	KIN12B540s130	*Triticum aestivum /durum*	4.5	3.2	2.4
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	5.3	3.4	2.9
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	4.3	3.4	2.6
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	4.5	2.8	2.4
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	4.4	3.2	2.5
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	5	3.5	3
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	4.6	3.3	2.8
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	4.5	3	2.8
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	4	2.9	1.8
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	5	3.4	2.8
KH-P II	KIN13A972s304	*Triticum aestivum /durum*	4.8	3.4	2
KH-P II	KIN18A1987s73	*Triticum aestivum /durum*	5	3.1	2.3
KH-P II	KIN18A1987s73	*Triticum aestivum /durum*	4.5	3	2.2
KH-P II	KIN14A1534s101	*Triticum* sp	5.3	3.4	2.8
KH-P II	KIN14A1534s101	*Triticum* sp	3.7	2.3	2
KH-P II	KIN14A1534s101	*Triticum* sp	4.2	3.4	2.5
KH-P II	KIN12A237s238	*Triticum aestivum /durum*	3.5	3	2.4
KH-P II	KIN12A237s238	*Triticum aestivum /durum*	5	3.2	2.5
KH-P II	KIN12A237s238	*Triticum aestivum /durum*	5.2	3.5	2.8
KH-P II	KIN12A237s238	*Triticum aestivum /durum*	4.3	3	2.5
KH-P II	KIN12A237s238	*Triticum aestivum /durum*	4.7	2.7	2.2
KH-P II	KIN12A237s238	*Triticum aestivum /durum*	4	3.5	2.5
KH-P II	KIN12A237s238	*Triticum aestivum /durum*	3.6	2.5	1.9
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5.8	3.3	2.3
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5.5	3.5	3
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5.4	3	2.3
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5.2	3.1	3
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5	3.1	2.5
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5	3.5	nr
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5.4	3.8	2.6
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5.8	3.2	2.5
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	4.8	3.8	2.7
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	4.4	3.7	2.6
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5.8	3.8	3
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	4.8	2.8	2.3
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	4.9	2.8	2.6
KH-P II	KIN13A950s242	*Triticum aestivum /durum*	5.5	3.4	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.2	3.2	2.8
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.1	3.2	3.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	3.5	2.7	2.1
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4	3.1	2.3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4	3.8	2.6
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.8	3.5	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.2	3.8	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.8	2

Period	Sample	ID	L	B	H
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.4	2.6
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.9	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.8	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.8	3.8	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.4	2.7	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.8	3	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.3	4	2.8
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.7	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.2	2.4	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.2	3.4	2.8
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.3	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	3.7	2.4	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.6	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.2	3.3	2.3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.8	2.6
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.2	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.8	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4	2.8	2.4
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.2	3.2	3.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3	2.8
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.8	3.6	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.8	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.1	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.8	3.8	2.6
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.2	3.4	2.3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.2	3.2	3.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.9	2.8
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4	2.4	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	2.9	2.4
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.9	3	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.8	3.5	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.3	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.5	3	2.6
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3	2.4
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.4	3.5	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.8	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.5	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	4.2	3.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.5	3.9	2.6
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	3.8	2.7	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.8	3.2	2.6
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4	3	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.8	3.4	2.6
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.7	3.9	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.7	3.2	2.5
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.3	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.3	2.9	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5.4	3.2	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.6	3.5	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.2	1.9

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.2	2.8	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.5	2.8
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	3.5	3
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	3.8	2.8	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.3	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4	3	2.2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	5	3.7	2.7
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	3.8	3	2.4
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	3.4	2.4	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	2.6	2
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	4.5	2.4	1.7
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	3.2	2.1	1.8
KH-P II	KIN13A939s257	*Triticum aestivum /durum*	2.2	1.4	1.3
KH-P II	KIN12A233s261	*Triticum aestivum /durum*	4.2	2.9	2.2
KH-P II	KIN12A233s261	*Triticum aestivum /durum*	5.2	3.5	2.9
KH-P II	KIN13A967s266	*Triticum aestivum /durum*	4.2	3.4	2.3
KH-P II	KIN13A967s266	*Triticum aestivum /durum*	5	3.4	3.2
KH-P II	KIN13A967s266	*Triticum aestivum /durum*	5	3.3	2.7
KH-P II	KIN13A967s266	*Triticum aestivum /durum*	5.5	3	2.5
KH-P II	KIN13A967s266	*Triticum aestivum /durum*	5	3.5	2.7
KH-P II	KIN13A967s266	*Triticum aestivum /durum*	5	2.9	2.2
KH-P II	KIN13A967s266	*Triticum aestivum /durum*	4.5	2.7	2.2
KH-P II	KIN12A233s273	*Triticum* sp	5.5	2.5	2.3
KH-P II	KIN12A233s273	*Triticum* sp	3.6	1.7	1.5
KH-P II	KIN12A233s273	*Triticum aestivum /durum*	4.5	3.5	2.8
KH-P II	KIN12A233s273	*Triticum aestivum /durum*	4.8	3.5	2.5
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4.7	3.6	2.8
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	3.9	3	2
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	5	3	2.5
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4	2.8	2.2
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4.8	3.5	2.6
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4.8	3.6	3.2
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4.6	3.4	3.2
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	3.5	2.1	1.6
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4.4	2.9	2.1
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	5	3.4	2.4
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	3.7	2.5	nr
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4.2	2.6	2.2
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	3.8	2.5	1.9
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	5	3.5	1.8
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4.5	3.5	2.6
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	4	2.5	2.1
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	2.8	1.8	1.8
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	2.5	1.4	1.6
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	2.5	1.5	1.4
KH-P II	KIN13A982s293	*Triticum aestivum /durum*	2.8	1.8	1.7
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	4.7	3	3
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	4	3	2.1
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	4.4	3	2.2
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	5.2	3.2	2.7

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	5.2	3.4	2.7
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	3.2	1.9	1.5
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	4.8	2.7	2
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	4	2.5	2
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	2.5	1.5	1
KH-P II	KIN12B549s138	*Triticum aestivum /durum*	2.5	1.7	1.4
KH-P II	KIN16B2196s59	*Triticum* sp	5.9	2.8	2.4
KH-P II	KIN16B2196s59	*Triticum aestivum /durum*	4.5	3.8	3.5
KH-P II	KIN16B2196s59	*Triticum aestivum /durum*	4.9	3.5	3
KH-P II	KIN16B2196s59	*Triticum aestivum /durum*	4.9	3.6	2.8
KH-P II	KIN16B2196s59	*Triticum aestivum /durum*	4	2.5	2
KH-P II	KIN15B2098s77	*Triticum aestivum /durum*	4.8	3.3	2.7
KH-P II	KIN15B2107s86	*Triticum dicoccum*	6.4	3.1	3.2
KH-P II	KIN15B2113s108	*Triticum aestivum /durum*	3.9	2.7	2.5
KH-P II	KIN14B2032s140	*Triticum aestivum /durum*	3.1	1.9	1.6
KH-P II	KIN14B2032s140	*Triticum aestivum /durum*	4	2.6	1.9
KH-P II	KIN14B2032s140	*Triticum aestivum /durum*	3.4	2.1	1.4
KH-P II	KIN14B2032s140	*Triticum aestivum /durum*	4.7	3.2	2.4
KH-P II	KIN14B2032s140	*Triticum aestivum /durum*	3.2	2.1	1.8
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5	2.6	2.1
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5	3.5	3.2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5.5	4	2.8
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.2	2.6	2.5
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.8	2.8	2.2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5.2	3	2.4
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5.4	3.4	3.5
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	3.7	2.4	2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.5	2.9	2.2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.3	3.2	2.2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.8	2.7	2.5
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5.2	3.2	2.9
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5	3.4	3
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5	3.3	2.7
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.7	3.2	2.5
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4	3.7	2.7
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.9	2.9	2.2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.7	2.9	2.4
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.7	2.5	2.1
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.5	3.5	2.8
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	3	2.3	2.1
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.7	3.5	2.5
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	3.4	2.5	2.4
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.2	3.3	nr
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.7	2.7	2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.8	3	2.2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.2	2.7	2.2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.8	3	2.5
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.5	2.7	2.3
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.9	3	2.6
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5.2	3.1	2.6
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5.2	3	2.5

Period	Sample	ID	L	B	H
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.2	3	2.7
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.4	2.8	2.4
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.2	3	2.3
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.6	2.6	1.8
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	5.4	3	2.8
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4	2.2	1.8
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.8	3	3
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.4	2.6	2
KH-P II	KIN16B2221s116	*Triticum aestivum /durum*	4.4	2.5	2.7
KH-P II	KIN16B2221s116	*Triticum* sp	4.2	2.3	2
KH-P II	KIN16B2221s116	*Triticum* sp	6.2	2.5	1.5
KH-P II	KIN16B2221s116	*Triticum* sp	4.5	2	1.8
KH-P II	KIN16B2221s116	*Triticum* sp	5	2.5	2.5
KH-P II	KIN13B565s126	*Triticum aestivum /durum*	4.2	3	2.8
KH-P II	KIN13B565s126	*Triticum aestivum /durum*	3.8	2.5	1.5
KH-P II	KIN13B565s126	*Triticum aestivum /durum*	4.7	3.1	2.4
KH-P II	KIN13B565s126	*Triticum aestivum /durum*	3.2	2.2	1.7
KH-P II	KIN13B565s126	*Triticum aestivum /durum*	3.8	2.1	1.8
KH-P II	KIN13B565s126	*Triticum aestivum /durum*	3.5	2.1	1.5
KH-P II	KIN13B565s126	*Triticum aestivum /durum*	3	2	1.9
KH-P II	KIN13B565s126	*Triticum* sp.	4.2	1.9	1.7
KH-P II	KIN14B845s152	*Triticum aestivum /durum*	4.5	2.9	2.2
KH-P II	KIN14B845s152	*Triticum aestivum /durum*	4.9	2.5	2.1
KH-P II	KIN14B845s152	*Triticum aestivum /durum*	4.5	2.8	2.1
KH-P II	KIN14B845s152	*Triticum aestivum /durum*	4	2.2	1.8
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5.3	3.4	2.8
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5.1	3.8	3
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4.7	3.1	2.5
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4.3	2.9	2.5
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4.2	2.8	2.1
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5.2	4.3	3.2
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5.5	3.5	2.4
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5.5	3.4	2.6
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4.7	3.5	2.5
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4.5	2.7	2
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4.5	3.7	2.5
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4.5	2.7	2.7
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5.4	3.9	2.7
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5	3.7	nr
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5	3	2.2
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5.2	2.9	2.2
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4	2.5	2.5
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	5.3	3.5	2.7
KH-P II	KIN14B2031s133	*Triticum aestivum /durum*	4	3.2	2
KH-P II	KIN14B2031s133	*Triticum* sp.	4.7	2.3	2
KH-P II	KIN14B2031s133	*Triticum* sp.	4.5	2.2	2
KH-P II	KIN14B2032s135a	*Triticum aestivum /durum*	3.5	2.2	2
KH-P II	KIN14B2032s135a	*Triticum aestivum /durum*	5	3.2	2.5
KH-P II	KIN13D1041s23	*Triticum aestivum /durum*	4.3	2.5	2.2
KH-P III	KIN13A175s117	*Triticum aestivum /durum*	4.9	3.2	3.3
KH-P III	KIN13A175s117	*Triticum aestivum /durum*	4.5	3.3	1.6

Period	Sample	ID	L	B	H
KH-P III	KIN13A175s117	*Triticum aestivum /durum*	5	3.8	3
KH-P III	KIN13A175s117	*Triticum aestivum /durum*	4.6	2.4	2
KH-P III	KIN13A175s117	*Triticum aestivum /durum*	3.7	2.4	2.1
KH-P III	KIN15A1685s131	*Triticum aestivum /durum*	3.2	5.4	2.5
KH-P III	KIN15A1685s131	*Triticum aestivum /durum*	4	2.8	2
KH-P III	KIN17A1790s135	*Triticum aestivum /durum*	4.3	2.8	1.8
KH-P III	KIN17A1790s135	*Triticum aestivum /durum*	4.5	2.5	2.2
KH-P III	KIN17A1790s135	*Triticum aestivum /durum*	4.8	2.8	2.3
KH-P III	KIN17A1790s135	*Triticum aestivum /durum*	5	2.8	2.3
KH-P III	KIN17A1790s135	*Triticum aestivum /durum*	6.2	3.5	3
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	5	3	2.1
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	4.2	3.2	3
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	4.7	2.8	2.2
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	4.2	3	2
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	4	2.5	2
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	4	3	2
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	4	2.8	2
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	5	3.5	3
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	4	3	2.8
KH-P III	KIN17A1893s149	*Triticum aestivum /durum*	3	2	1.5
KH-P III	KIN17A1893s149	*Triticum* sp.	5	2.5	2.2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5	3.7	2.4
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5	3.6	3
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.9	3.8	2.7
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.7	3.5	2.5
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	3.1	2.2	1.9
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	3.3	2.6	2.2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.8	2.7	2.3
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.6	3.7	3
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	3.9	2.5	2.2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5.5	3.4	3
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4	3.8	2.2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5	3.1	2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5.5	3.3	2.5
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5.4	2.9	2.5
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.2	2.5	1.9
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	3.7	2.3	1.6
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5	2.8	2.2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.5	3.7	2.6
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.7	3	2.3
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.8	3.2	2.5
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5.1	3.5	3
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	5	3.4	2.4
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4	3	2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.5	2.9	2.2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	3.9	2.2	2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.5	3.2	2.7
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.5	2.6	2.2
KH-P III	KIN17A1894s157	*Triticum aestivum /durum*	4.4	2.8	2.3
KH-P III	KIN17A1894s157	*Triticum* sp.	5	2.2	2
KH-P III	KIN17A1894s157	*Triticum* sp.	5.5	2.7	2.7

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P III	KIN17A1894s157	*Triticum* sp.	4.7	2	1.9
KH-P III	KIN17A1894s157	*Triticum* sp.	4.8	1.8	1.7
KH-P III	KIN17A1894s157	*Triticum* sp.	4.9	2.5	2.2
KH-P III	KIN17A1894s157	*Triticum* sp.	4.5	2.4	1.8
KH-P III	KIN17A1894s158	*Triticum aestivum /durum*	5.2	3	2.2
KH-P III	KIN17A1894s158	*Triticum aestivum /durum*	5	3.5	2.5
KH-P III	KIN17A1894s158	*Triticum aestivum /durum*	4.2	3	2.5
KH-P III	KIN12A231s258	*Triticum aestivum /durum*	3.9	3	2.5
KH-P III	KIN12A231s258	*Triticum aestivum /durum*	5	3.2	2.2
KH-P III	KIN12A231s258	*Triticum aestivum /durum*	4.2	3.2	2.2
KH-P III	KIN12A231s258	*Triticum aestivum /durum*	3.8	2.6	1.8
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	5.2	3.4	3
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	2.6	2	1.5
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	5.1	3.1	3
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	4.6	3.3	2.5
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	4.2	3	2
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	4.4	3.7	2.7
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	3.8	3	2
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	4.5	3.5	3.2
KH-P III	KIN18A1902s4	*Triticum aestivum /durum*	3.5	2.3	1.6
KH-P III	KIN16A1683s4	*Triticum aestivum /durum*	5.8	4.3	3
KH-P III	KIN16A1683s4	*Triticum* sp.	5.2	1.7	2
KH-P III	KIN16A1683s4	*Triticum* sp.	5.2	2	2
KH-P III	KIN16A1721s55	*Triticum aestivum /durum*	5.2	2.7	2.2
KH-P III	KIN17A1771s65	*Triticum aestivum /durum*	4.4	3.3	2.7
KH-P III	KIN17A1771s65	*Triticum aestivum /durum*	3.5	5.5	2.3
KH-P III	KIN17A1771s61	*Triticum aestivum /durum*	4.6	2.8	2.1
KH-P III	KIN17A1771s61	*Triticum aestivum /durum*	4.8	2.6	2.2
KH-P III	KIN16A1711s67	*Triticum aestivum /durum*	4.8	3.4	2
KH-P III	KIN16A1711s67	*Triticum aestivum /durum*	4.9	3.5	2.7
KH-P III	KIN16A1711s67	*Triticum aestivum /durum*	4.6	3.3	2.2
KH-P III	KIN16A1711s67	*Triticum aestivum /durum*	3.7	2.5	1.8
KH-P III	KIN16A1732s70	*Triticum aestivum /durum*	4.5	2.5	2
KH-P III	KIN15A1668s85	*Triticum aestivum /durum*	4.5	3	2.5
KH-P III	KIN15A1668s85	*Triticum aestivum /durum*	4.5	2.9	2.4
KH-P III	KIN18A1996s91	*Triticum aestivum /durum*	5	3	2.8
KH-P III	KIN18A1996s91	*Triticum dicoccum*	5.2	2.7	2.3
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	5.2	3	2.5
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.8	2.6	2
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	5.2	3.2	2.5
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.5	3.2	2.4
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.7	3	2.4
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.7	2.8	2.2
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.3	2.9	2.2
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.5	3.1	2
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	3.9	2.4	1.7
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.6	3.4	1.2
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.2	2.6	1.8
KH-P III	KIN15A1676s93	*Triticum aestivum /durum*	4.6	3.1	2.2
KH-P III	KIN16A1745s95	*Triticum aestivum /durum*	4.8	3.3	2.2
KH-P III	KIN16A1745s95	*Triticum aestivum /durum*	4.7	2.8	2.4

Period	Sample	ID	L	B	H
KH-P III	KIN16A1745s95	*Triticum aestivum /durum*	4.5	3.1	2.2
KH-P III	KIN16A1745s95	*Triticum aestivum /durum*	3	2.8	22
KH-P III	KIN16A1745s95	*Triticum aestivum /durum*	4.7	2.6	2
KH-P III	KIN16A1745s95	*Triticum aestivum /durum*	4.5	2.8	2.2
KH-P III	KIN16A1745s95	*Triticum aestivum /durum*	4.3	3	2.1
KH-P III	KIN16A1745s95	*Triticum* sp	4.4	2.4	2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.4	3	2.5
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4	2.5	2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.2	2.5	2.2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	5	3	2.2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	3.8	2.3	1.5
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.9	3.5	2.8
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4	2.5	2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4	2.5	1.8
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	5.2	2.9	2.2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.5	2.6	2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4	3.2	3
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	5.5	3.2	2.4
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.5	3	2.5
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.8	3	1.9
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.8	4	2.8
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.5	3	2.8
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	5.2	3.5	2.5
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.4	2.7	2.5
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.5	3.3	2.7
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.8	3	2.2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.5	3.5	2.8
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4	2.8	2.2
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.5	3	2.1
KH-P III	KIN14B807s38a	*Triticum aestivum /durum*	4.7	2.8	2.5
KH-P III	KIN14B807s38a	*Triticum* sp	5.7	3	2.7
KH-P III	KIN14B807s38a	*Triticum* sp	3.9	2	1.4
KH-P III	KIN14B807s38a	*Triticum* sp	4.5	2.2	2
KH-P III	KIN14B807s38a	*Triticum* sp	4.4	2.3	2
KH-P III	KIN14B807s38a	*Triticum* sp	4.2	2.2	1.8
KH-P III	KIN14B807s38b	*Triticum aestivum /durum*	4.8	2.8	2.4
KH-P III	KIN14B807s38b	*Triticum aestivum /durum*	4.6	3.3	3
KH-P III	KIN14B807s38b	*Triticum aestivum /durum*	4.8	3.2	2.5
KH-P III	KIN14B807s38b	*Triticum aestivum /durum*	4.4	3.2	2.6
KH-P III	KIN14B807s38b	*Triticum aestivum /durum*	4.4	2.9	2
KH-P III	KIN14B807s38b	*Triticum aestivum /durum*	4.5	2.8	2
KH-P III	KIN14B807s38b	*Triticum aestivum /durum*	4	3.2	2.4
KH-P III	KIN14B807s38b	*Triticum aestivum /durum*	4.5	2.7	2
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.7	2.9	2.5
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	3.1	2.2	1.6
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	3.3	2.1	1.7
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.9	3	2
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.7	3.1	2.5
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.3	3	2.6
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.5	3	2.2
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.4	3	2.2

Period	Sample	ID	L	B	H
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	3.7	2.5	2.1
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.3	2.6	2.2
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.5	3.5	2.5
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.8	3	2
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.2	2.6	2.5
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.5	3.1	3
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.7	3.5	2.4
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4.2	3.1	2.5
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	5.1	3..0	2.8
KH-P III	KIN14B899s91	*Triticum aestivum /durum*	4	3	2.6
KH-P III	KIN14B899s91	*Triticum* sp	5	2.5	2
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	4.2	2.7	2
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	5.2	2.8	2.3
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	4.5	3.5	2.6
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	4.9	3.1	2.5
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	4.5	3.2	2.5
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	4.4	2.7	2
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	4	2.1	1.6
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	2.8	2	1.6
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	4.5	2.7	2.1
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	3.6	3	2.5
KH-P III	KIN14B2002s105	*Triticum aestivum /durum*	3.5	2.3	1.7
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.2	2.8	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.5	2.2	1.8
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.3	2.6	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5.1	2.8	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.5	2.8	2.1
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.5	2.5	1.8
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4	2.5	2.2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.2	2.5	1.8
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.7	2.6	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5.1	3	2.5
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.5	2.9	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.2	2	1.6
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.3	2.2	1.8
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4	2.8	2.1
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.8	2.9	2.2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.5	2.4	nr
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.7	2	1.7
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5.5	2.8	nr
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4	2.5	2.4
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.2	2.8	2.2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.1	2.4	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.5	3	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.9	2.8	2.2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4	2.4	1.7
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5	3.1	2.5
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5	3.1	2.6
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5	3.1	2.5
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.7	3	2.4
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.2	2.4	2

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.7	2.8	2.3
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5	2.9	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5.2	3.1	2.6
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4	2.5	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.5	2.2	1.7
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.3	2.6	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.5	2.5	0.2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.2	2.6	2.6
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.5	2.4	1.8
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4	2.6	2.2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5	3	nr
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5.6	2.3	nr
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.8	2.7	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3	2.5	2.1
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	5.2	3	2.5
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	2.8	2.2	1.5
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4	2.8	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	6.8	3.2	2.5
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.6	2.5	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.2	2.8	2.1
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.5	3	2.1
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4	2.5	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.6	2.8	2
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.8	2.5	2.4
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.2	2.2	1.8
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	4.6	3.3	2.3
KH-P III	KIN14B2002s106	*Triticum aestivum /durum*	3.8	3	2.1
KH-P III	KIN14B2002s106	*Triticum dicoccum*	5.5	2.6	2
KH-P III	KIN14B2002s106	*Triticum dicoccum*	4	1.8	1.4
KH-P III	KIN14B2002s106	*Triticum dicoccum*	4	2.3	1.6
KH-P III	KIN14B2002s106	*Triticum* sp	5.4	2.8	2.4
KH-P III	KIN14B2002s106	*Triticum* sp	4.5	2.1	1.4
KH-P III	KIN14B2002s106	*Triticum* sp	5	2.7	2.2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.8	2	1.4
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.2	2.6	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3	1.9	1.7
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.1	1.8	1.5
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.2	3	2.4
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.2	2.2	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.6	1.9	1.4
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.5	2	1.6
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.5	2.3	1.9
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.3	2.7	2.2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.7	2.3	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.6	2.2	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.4	1.9	1.7
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.8	2.5	nr
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4	2.7	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.2	2.7	2.2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	5	3	2.9
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.4	2.4	1.8

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.2	2.6	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4	2.3	nr
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.2	2.2	1.7
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.5	2.8	2.2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.6	2.3	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.4	2.2	nr
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3	1.8	1.9
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.6	2.6	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	5.2	2.6	2.4
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4	2.4	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.2	2.1	1.7
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.7	1.6	1.5
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.3	2.5	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4	2.5	2.1
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.3	2.5	1.5
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.8	2.8	2.4
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.8	2.2	1.8
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.2	1.9	1.5
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	5.2	3.4	2.7
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.6	2.8	2.5
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.5	2.1	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.2	2.5	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.5	2.8	2.1
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4	3.1	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.5	3.3	3.1
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3	2.1	2.1
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	4.7	3.3	2.6
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.7	1.9	1.5
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.8	1.9	1.9
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.2	2.1	1.7
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	5	3	2.6
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	5	2.9	2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.5	1.4	1.2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.8	1.8	1.4
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.1	1.9	1.5
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3	2	1.4
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.8	2	1.6
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	3.3	1.6	1
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.6	1.5	1.3
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.5	1.7	1.2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2	1.5	1.2
KH-P III	KIN14B2002s106b	*Triticum aestivum /durum*	2.4	1.6	1.2
KH-P III	KIN14B2002s106b	*Triticum* sp	5	2.5	2
KH-P III	KIN14B2002s106b	*Triticum* sp	4.6	2.1	2.2
KH-P III	KIN14B2002s106b	*Triticum* sp	3.9	1.9	1.6
KH-P III	KIN14B2002s106b	*Triticum* sp	4.4	2.1	1.7
KH-P III	KIN14B2002s106b	*Triticum* sp	4	2	1.6
KH-P III	KIN14B2002s106b	*Triticum* sp	4	2.2	2
KH-P III	KIN14B876s115	*Triticum aestivum /durum*	4.7	2.6	2.2
KH-P III	KIN14B876s115	*Triticum aestivum /durum*	5.3	3.4	3
KH-P III	KIN14B876s115	*Triticum aestivum /durum*	3.7	2.6	2

Period	Sample	ID	L	B	H
KH-P III	KIN14B876s115	*Triticum aestivum /durum*	4.5	2.4	1.6
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	4.2	3.2	2.5
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	4.5	2.7	2
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	3.4	2.5	2.2
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	4.2	2.8	2.2
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	5	3.3	2.8
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	5	3	2.4
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	5	2.7	2.3
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	4	2.8	2.3
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	5	4	2.7
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	4.5	3.3	2.8
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	4.8	2.9	2.3
KH-P III	KIN14B807s125	*Triticum aestivum /durum*	5	3.5	2.7
KH-P III	KIN13B790s152	*Triticum aestivum /durum*	4.8	3.5	2.8
KH-P III	KIN13B790s152	*Triticum aestivum /durum*	4.2	2.5	2
KH-P III	KIN13B790s152	*Triticum aestivum /durum*	3	2	1.9
KH-P III	KIN13B790s152	*Triticum aestivum /durum*	4	2.2	1.8
KH-P III	KIN13B802s162	*Triticum aestivum /durum*	3.8	3.4	2
KH-P III	KIN13B802s162	*Triticum aestivum /durum*	4.5	2.8	2.5
KH-P III	KIN13B802s162	*Triticum aestivum /durum*	5.5	3.2	2.8
KH-P III	KIN13B802s162	*Triticum aestivum /durum*	3.9	3	2.2
KH-P III	KIN13B802s162	*Triticum aestivum /durum*	5	2.8	2
KH-P III	KIN13B804s167	*Triticum aestivum /durum*	4	2.8	2.1
KH-P III	KIN13B804s167	*Triticum aestivum /durum*	3.5	2	2
KH-P III	KIN13B804s167	*Triticum aestivum /durum*	5.5	3.5	2.5
KH-P III	KIN13B804s167	*Triticum aestivum /durum*	4.8	3.5	2.5
KH-P III	KIN13B804s167	*Triticum aestivum /durum*	2.8	2	1.8
KH-P III	KIN13B804s167	*Triticum aestivum /durum*	4.8	2.5	1.8
KH-P III	KIN13B804s167	*Triticum aestivum /durum*	3.3	2.6	2.3
KH-P III	KIN13B804s167	*Triticum* sp	5.3	2.4	1.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.5	3.2	2.6
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.5	3.5	3.4
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.5	2.8	2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	3.5	2.6	2.3
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	3.3	2.2	1.8
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4	3.1	2.2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.2	3	2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5.7	3.4	2.8
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.5	3	2.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	3.2	2	1.8
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5.5	3.3	2.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.3	3.1	3
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4	2.9	2.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5.5	3	2.2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.4	2.7	2.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5.5	4	3
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5	2.8	2.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.5	3	2.2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.6	3	2.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5	3.4	2.4
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	3.5	2.3	1.7

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5	3.4	2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.8	2.8	2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.5	3.3	2.2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.6	2.8	1.9
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.6	2.5	1.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5	3.2	2.8
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	5.2	3.7	2.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4	2.8	2.2
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	4.8	4	2.5
KH-P III	KIN13B807s175	*Triticum aestivum /durum*	6	4	3
KH-P III	KIN13B807s175	*Triticum* sp	7	3.5	3
KH-P III	KIN13B807s175	*Triticum* sp	4.6	2.2	1.5
KH-P III	KIN13B807s175	*Triticum* sp	4.6	2.3	2
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	3.2	2	1.6
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	4.1	2.5	2
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	4.9	3.5	2.4
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	3.5	2.4	2
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	5	2.9	2.2
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	3	2	1.9
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	3.5	2	1.8
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	5	3.8	2.8
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	4.2	2.6	2
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	3.8	2.5	2
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	3	2	1.8
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	3.1	1.8	1.1
KH-P III	KIN16D2416s37	*Triticum aestivum /durum*	3	1.8	1.3
KH-P III	KIN16D2416s37	*Triticum dicoccum*	5.7	2.5	2
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	5.2	3.2	2.9
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	3.7	2.5	2.5
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	4.5	3.1	2.5
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	3.7	2.3	1.8
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	3.5	2.2	1.8
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	4.2	3	2
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	4.5	2.8	2.5
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	4.6	3	2.4
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	3.5	2.5	2.4
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	2.5	2	1.7
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	2.8	1.9	1.7
KH-P III	KIN14D1155s20	*Triticum aestivum /durum*	3.4	2	1.5
KH-P III	KIN14D1124s4	*Triticum aestivum /durum*	4.9	2.8	2.2
KH-P III	KIN13D1144s185	*Triticum aestivum /durum*	4.5	2.9	2
KH-P III	KIN13D1144s185	*Triticum aestivum /durum*	4	2.8	2.2
KH-P III	KIN13D1144s185	*Triticum aestivum /durum*	4.4	2.8	2
KH-P III	KIN14D2385s150	*Triticum aestivum /durum*	5.1	3	2.2
KH-P III	KIN14D2385s150	*Triticum aestivum /durum*	4.5	3	2.5
KH-P III	KIN14D2385s150	*Triticum aestivum /durum*	4.8	3.2	2.4
KH-P III	KIN14D2385s150	*Triticum aestivum /durum*	4.3	3.1	2.1
KH-P III	KIN14D2385s150	*Triticum aestivum /durum*	4.6	3.3	2.5
KH-P III	KIN14D2385s150	*Triticum aestivum /durum*	3.8	2.5	2.3
KH-P III	KIN14D2385s150	*Triticum aestivum /durum*	4.2	2.6	2.1
KH-P III	KIN14D2385s150	*Triticum aestivum /durum*	5	3.2	2.3

Period	Sample	ID	L	B	H
KH-P III	KIN14D2314s140	*Triticum aestivum /durum*	5.4	3.8	3.2
KH-P III	KIN15D2379s117	*Triticum aestivum /durum*	4.7	3.6	3.5
KH-P III	KIN15D2379s117	*Triticum aestivum /durum*	4.6	2.8	2.2
KH-P III	KIN15D2379s117	*Triticum aestivum /durum*	5.2	3.5	3
KH-P III	KIN15D2379s117	*Triticum aestivum /durum*	5.2	3.4	2.7
KH-P III	KIN15D2379s117	*Triticum* sp	4.9	2.3	1.8
KH-P III	KIN14D2302s102	*Triticum aestivum /durum*	3.2	2	2
KH-P III	KIN14D2302s102	*Triticum aestivum /durum*	4.2	2.9	2
KH-P III	KIN14D2302s102	*Triticum aestivum /durum*	4.5	3	2.2
KH-P III	KIN14D2302s102	*Triticum aestivum /durum*	4	3	2
KH-P III	KIN14D1192s101	*Triticum aestivum /durum*	3.6	2.1	2
KH-P III	KIN14D1192s101	*Triticum* sp	4	1.8	1.3
KH-P III	KIN14D1109s95	*Triticum aestivum /durum*	4.6	3.5	3
KH-P III	KIN14D1109s95	*Triticum aestivum /durum*	3.4	2.2	2.2
KH-P III	KIN14D1109s95	*Triticum aestivum /durum*	3.2	2.1	1.5
KH-P III	KIN14D1192s88	*Triticum aestivum /durum*	4	3	2
KH-P III	KIN14D1192s88	*Triticum aestivum /durum*	2.8	1.7	1.2
KH-P III	KIN14D1192s88	*Triticum aestivum /durum*	3	1.9	1.5
KH-P III	KIN14D1149s73	*Triticum aestivum /durum*	5.6	3.4	2.9
KH-P III	KIN15D2348s38	*Triticum aestivum /durum*	5.6	4	2.8
KH-P III	KIN15D2348s38	*Triticum aestivum /durum*	4.4	3	2.6
KH-P III	KIN15D2348s38	*Triticum* sp	6.9	3	2.6
KH-P III	KIN14D1166s52a	*Triticum aestivum /durum*	4.5	3.3	2.8
KH-P III	KIN14D1166s52a	*Triticum aestivum /durum*	5.2	3.5	2.7
KH-P III	KIN14D1166s52a	*Triticum aestivum /durum*	5.2	3.4	2.4
KH-P III	KIN14D1166s52a	*Triticum aestivum /durum*	4.5	2.5	2.2
KH-P III	KIN14D1166s52a	*Triticum* sp	4.3	2	1.5
KH-P III	KIN14S1166s52b	*Triticum aestivum /durum*	4.5	3	2.6
KH-P III	KIN14S1166s52b	*Triticum aestivum /durum*	4.5	3.4	3
KH-P IV	KIN18A1397s36	*Triticum* sp	4.6	2.4	2
KH-P IV	KIN18A1397s36	*Triticum aestivum /durum*	4.8	2.9	2.5
KH-P IV	KIN18A1397s36	*Triticum aestivum /durum*	5	3	2.6
KH-P IV	KIN18A1397s36	*Triticum aestivum /durum*	4.5	2.8	2.8
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.6	2.3	2
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.3	2.6	2.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.6	3	2.2
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.8	2.5	2
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.2	3	2.2
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.6	2.4	2
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	5	2.9	2.7
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.4	3.3	2.6
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.9	2.7	2.1
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.6	3.1	2.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.7	3	2.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	2.8	2.9	2.6
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4	2.5	1.9
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3	2.5	2
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.7	3.2	2.6
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.1	2.5	1.8
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.2	3.3	1.8
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4	2.5	1.9

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.6	3.5	2.6
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.2	2.9	2.1
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.9	2.3	2.2
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	5	2.9	2.4
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.5	2.8	2.1
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.7	3.2	2.2
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.9	3	2.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.4	3.6	2.6
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.4	3.2	2.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.5	2.3	1.7
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4.2	3.5	2.6
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	4	2.9	2.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.7	2.5	1.6
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3.7	2.5	2.1
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	2.2	1.6	1.3
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	3	2	1.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	2.7	2	1.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	1.7	1	1
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	2.6	1.8	1.5
KH-P IV	KIN18A1379s31	*Triticum aestivum /durum*	2.8	1.8	1.4
KH-P IV	KIN18A1379s31	*Triticum* sp	5	2.7	2
KH-P IV	KIN18A1379s31	*Triticum* sp	4	2.1	1.5
KH-P IV	KIN18A1379s31	*Triticum* sp	4.8	2.5	2.2
KH-P IV	KIN18A1379s31	*Triticum* sp	4.8	2.2	1.8
KH-P IV	KIN18A1379s31	*Triticum* sp	4.4	2.4	2
KH-P IV	KIN18A1379s31	*Triticum* sp	3.8	2.1	1.8
KH-P IV	KIN18A1379s31	*Triticum* sp	4.8	2.2	2.1
KH-P IV	KIN18A1379s31	*Triticum* sp	4.5	2	1.6
KH-P IV	KIN18A1379s31	*Triticum* sp	3.2	1.6	1.3
KH-P IV	KIN18A1379s31	*Triticum* sp	4.5	1.8	1.5
KH-P IV	KIN18A1379s31	*Triticum* sp	2.8	1.4	1
KH-P IV	KIN18A1379s31	*Triticum* sp	3.5	1.6	1.5
KH-P IV	KIN18A1377s3	*Triticum* sp	5.8	3	2.8
KH-P IV	KIN18A1377s3	*Triticum* sp	5	2.5	1.8
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	4.5	3	2.2
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	5	2.7	2.5
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	4.5	3.8	2.4
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	4.2	3	2.6
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	3.5	2.3	1.7
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	3.5	2.6	2
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	3.8	2.4	2.2
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	5	3.7	3
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	4.8	2.8	2.2
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	3.8	2.4	2.2
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	2.8	1.9	2
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	4.7	3.2	2.6
KH-P IV	KIN18A1377s3	*Triticum aestivum /durum*	4	2.5	2.5
KH-P IV	KIN12A291s313	*Triticum aestivum /durum*	4.8	3.2	3.1
KH-P IV	KIN12A291s313	*Triticum aestivum /durum*	4	2.8	2
KH-P IV	KIN12A291s313	*Triticum aestivum /durum*	4.8	3.8	3
KH-P IV	KIN12A291s313	*Triticum aestivum /durum*	4.3	2.8	2.4

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P IV	KIN12A291s313	*Triticum aestivum /durum*	3.3	2.7	2.4
KH-P IV	KIN12A291s313	*Triticum aestivum /durum*	5.5	3.5	2.5
KH-P IV	KIN12A291s313	*Triticum* sp	3.7	1.8	1.6
KH-P IV	KIN12A291s313	*Triticum* sp	3.6	1.7	1.4
KH-P IV	KIN12A281s300	*Triticum aestivum /durum*	4.7	3	2.5
KH-P IV	KIN12A281s300	*Triticum aestivum /durum*	5.5	4	2.5
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	5.4	3.2	3
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.5	2.5	2.2
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	3.3	2.1	1.8
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	2.3	2.2	1.7
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.2	3	nr
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4	2.1	1.2
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.8	3.7	2.6
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	5	3.6	3
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.8	3.9	3.1
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	3.8	2.3	2
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.5	2.7	2.2
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4	2.2	2.2
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.5	2.5	2.5
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.1	2.4	2.2
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	3.9	3	3
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4	3	2.8
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	3.8	2.4	2.2
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	3.8	2.3	1.8
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	3.2	2.4	2.2
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.5	3.2	2.4
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.2	2.7	2.4
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	5.3	3.5	3
KH-P IV	KIN17A1878s165	*Triticum aestivum /durum*	4.4	2.5	2.2
KH-P IV	KIN17C2853s81	*Triticum aestivum /durum*	4.5	2.8	2
KH-P IV	KIN17C2853s81	*Triticum aestivum /durum*	4.5	2.9	2.2
KH-P IV	KIN17C2853s81	*Triticum aestivum /durum*	3.1	1.8	1.5
KH-P IV	KIN17C2841s67	*Triticum aestivum /durum*	3.8	2.9	2.2
KH-P IV	KIN17C2841s67	*Triticum aestivum /durum*	3.6	2.2	1.9
KH-P IV	KIN17C2841s67	*Triticum aestivum /durum*	4.8	2.9	2.4
KH-P IV	KIN17C2841s67	*Triticum aestivum /durum*	4.2	3.1	2.5
KH-P IV	KIN17C2841s67	*Triticum aestivum /durum*	4	2.5	2
KH-P IV	KIN17C2841s67	*Triticum aestivum /durum*	4	2.3	1.9
KH-P IV	KIN17C2841s67	*Triticum aestivum /durum*	2.8	2.1	1.7
KH-P IV	KIN17C2841s67	*Triticum* sp	4.5	2.3	2
KH-P IV	KIN17C2841s67	*Triticum* sp	3.5	1.8	1.5
KH-P IV	KIN17C665s63	*Triticum dicoccum*	4.2	1.8	2
KH-P IV	KIN16C2672s9999	*Triticum aestivum /durum*	5.4	3.4	2.4
KH-P IV	KIN16C2672s9999	*Triticum aestivum /durum*	3.5	2	1.3
KH-P IV	KIN17C2838s61	*Triticum aestivum /durum*	4.4	2.9	2.5
KH-P IV	KIN17C2838s61	*Triticum aestivum /durum*	4.3	2.8	2.5
KH-P IV	KIN17C2838s61	*Triticum aestivum /durum*	3.7	3.2	2.6
KH-P IV	KIN17C2838s61	*Triticum aestivum /durum*	4.2	3.5	2
KH-P IV	KIN17C2838s61	*Triticum aestivum /durum*	3	2.2	1.7
KH-P IV	KIN17C2830s40	*Triticum aestivum /durum*	5.5	3.5	3.5
KH-P IV	KIN17C2830s40	*Triticum aestivum /durum*	3.5	2.2	1.8

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P IV	KIN17C2830s40	*Triticum aestivum /durum*	5	3.5	2.5
KH-P IV	KIN17C2830s40	*Triticum aestivum /durum*	4	2.4	2.1
KH-P IV	KIN17C2830s40	*Triticum dicoccum*	5	2.1	2.2
KH-P IV	KIN17C2833s47	*Triticum aestivum /durum*	3.8	2.2	1.5
KH-P IV	KIN17C2833s47	*Triticum aestivum /durum*	4.2	2.5	2
KH-P IV	KIN17C2833s47	*Triticum aestivum /durum*	5	3	2.5
KH-P IV	KIN17C2833s47	*Triticum aestivum /durum*	5.5	3.5	3
KH-P IV	KIN17C2834s51	*Triticum aestivum /durum*	4.6	3.9	2.9
KH-P IV	KIN17C2834s51	*Triticum aestivum /durum*	4.8	3.4	2.7
KH-P IV	KIN17C2834s51	*Triticum aestivum /durum*	4	2.7	2.4
KH-P IV	KIN17C2834s51	*Triticum aestivum /durum*	4	2.9	2.5
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	5	3	2.8
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	4	2.4	2.6
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	3.3	2.5	2.1
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	4.5	3	2.4
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	4.5	3.5	2.2
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	5.3	3.2	2.7
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	5	3.2	2.2
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	4.4	2.2	1.8
KH-P IV	KIN18C2870s15	*Triticum aestivum /durum*	4.3	2.8	2.3
KH-P IV	KIN17C2805s16	*Triticum aestivum /durum*	4.9	2.7	2.1
KH-P IV	KIN17C2805s16	*Triticum aestivum /durum*	4.2	2.6	2
KH-P IV	KIN17C2805s16	*Triticum aestivum /durum*	4.4	4	3.8
KH-P IV	KIN17C2805s16	*Triticum aestivum /durum*	4.6	2.8	2.5
KH-P IV	KIN17C2812s22	*Triticum aestivum /durum*	5	3	2.5
KH-P IV	KIN17C2812s22	*Triticum aestivum /durum*	5	3	2.5
KH-P IV	KIN17C2812s22	*Triticum aestivum /durum*	3.8	3	2
KH-P IV	KIN17C2812s22	*Triticum aestivum /durum*	4.8	3	2.6
KH-P IV	KIN17C2812s22	*Triticum aestivum /durum*	4	1	1.8
KH-P IV	KIN17C2812s22	*Triticum aestivum /durum*	4	2.8	2.5
KH-P IV	KIN17C2814s27	*Triticum aestivum /durum*	5.5	3.5	2.3
KH-P IV	KIN17C2814s27	*Triticum aestivum /durum*	3.8	2.5	2
KH-P IV	KIN17C642s30	*Triticum aestivum /durum*	4.5	2.9	2
KH-P IV	KIN17C2811s32	*Triticum aestivum /durum*	4	3.3	2.7
KH-P IV	KIN17C2825s38	*Triticum aestivum /durum*	4.2	3	2.5
KH-P IV	KIN17C2825s38	*Triticum aestivum /durum*	4.5	3	2.5
KH-P IV	KIN18C2874s5	*Triticum aestivum /durum*	5.5	3.5	3
KH-P IV	KIN18C2874s5	*Triticum aestivum /durum*	6	4	3
KH-P IV	KIN18C2874s5	*Triticum aestivum /durum*	6	4	2.5
KH-P IV	KIN18C2874s5	*Triticum aestivum /durum*	6	4	2.5
KH-P IV	KIN15C2520s11	*Triticum aestivum /durum*	4.8	3.3	2.3
KH-P IV	KIN15C2520s11	*Triticum aestivum /durum*	4.1	2.8	2.6
KH-P IV	KIN15C2520s11	*Triticum aestivum /durum*	4.5	2.5	2.4
KH-P IV	KIN15C2520s11	*Triticum aestivum /durum*	3.8	2.1	2
KH-P IV	KIN15C2520s11	*Triticum aestivum /durum*	3.5	2.2	2
KH-P IV	KIN15C2520s11	*Triticum aestivum /durum*	4	2.2	2
KH-P IV	KIN15C2520s11	*Triticum aestivum /durum*	2.8	1.9	1.6
KH-P IV	KIN17C2683s13	*Triticum aestivum /durum*	5.7	3	2.5
KH-P IV	KIN17C2683s13	*Triticum aestivum /durum*	4	2.9	2.5
KH-P IV	KIN17C2683s13	*Triticum aestivum /durum*	4.2	2.5	2.2
KH-P IV	KIN17C2683s13	*Triticum aestivum /durum*	2.7	1.9	2.3

Period	Sample	ID	L	B	H
KH-P IV	KIN17C2683s13	*Triticum* sp	5	2.5	2
KH-P IV	KIN17C2683s13	*Triticum* sp	5.2	2.1	1.8
KH-P VA	KIN17A1402s4	*Triticum aestivum* /*durum*	4.2	3.4	2.9
KH-P VA	KIN17A1402s4	*Triticum aestivum* /*durum*	4.9	2.7	1.6
KH-P VA	KIN17A1402s4	*Triticum aestivum* /*durum*	5.7	4	3
KH-P VA	KIN17A1402s4	*Triticum aestivum* /*durum*	4.7	3	2.6
KH-P VA	KIN17A1402s4	*Triticum aestivum* /*durum*	4	3	2.4
KH-P VA	KIN17A1402s4	*Triticum aestivum* /*durum*	3.5	2.4	2
KH-P VA	KIN17A1402s4	*Triticum aestivum* /*durum*	4	2.3	1.8
KH-P VA	KIN17A1406s17	*Triticum aestivum* /*durum*	5	3.5	2.8
KH-P VA	KIN17A1406s17	*Triticum aestivum* /*durum*	4.8	3	2.5
KH-P VA	KIN17A1406s17	*Triticum aestivum* /*durum*	4.2	2.5	2
KH-P VA	KIN17A164s26	*Triticum aestivum* /*durum*	3.2	1.9	1.8
KH-P VA	KIN17A164s26	*Triticum aestivum* /*durum*	4	2.7	2.6
KH-P VA	KIN17A164s26	*Triticum aestivum* /*durum*	4.4	3.4	2.2
KH-P VA	KIN17A164s26	*Triticum aestivum* /*durum*	4.5	2.8	2.1
KH-P VA	KIN17A164s26	*Triticum aestivum* /*durum*	5.2	3	2.1
KH-P VA	KIN17A164s26	*Triticum aestivum* /*durum*	5	3	2.8
KH-P VA	KIN17A164s26	*Triticum aestivum* /*durum*	3.9	2	1.8
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	5	3.7	2.6
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4	2.5	2
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	5	3.3	2.5
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.5	2.9	2.6
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.5	3.9	3
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.5	3	2.5
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.8	4.3	3.4
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.4	3.4	3.2
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.5	2.9	2
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	5.2	2.5	2.1
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	5	3	3
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	5.3	3.7	3
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	5.5	3.5	3
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.5	3	2.5
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	5	2.9	2.5
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	5.4	3.2	2.6
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.7	3	2.5
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.1	2.5	2.5
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.8	3	2
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.2	2.7	2.4
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.8	3	2.9
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	3.7	2.8	2.4
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.4	2.7	2.2
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	4.2	3.2	1.6
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	3.2	2.1	1.8
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	3.6	2.6	1.8
KH-P VA	KIN14A153s32	*Triticum aestivum* /*durum*	2.9	2.1	1.8
KH-P VA	KIN17A1410s34	*Triticum aestivum* /*durum*	4.6	3.5	2.7
KH-P VA	KIN17A1410s34	*Triticum aestivum* /*durum*	4.7	3.7	3.1
KH-P VA	KIN17A1410s34	*Triticum aestivum* /*durum*	5.1	4.2	3.5
KH-P VA	KIN17A1410s34	*Triticum aestivum* /*durum*	4.3	3	2.8
KH-P VA	KIN17A1410s34	*Triticum aestivum* /*durum*	4.2	2.8	2.3

Period	Sample	ID	L	B	H
KH-P VA	KIN17A1410s34	*Triticum aestivum /durum*	3.6	2.5	2
KH-P VA	KIN17A164s55	*Triticum aestivum /durum*	4.8	3.2	1.8
KH-P VA	KIN17A164s55	*Triticum aestivum /durum*	5	2.8	2.2
KH-P VA	KIN17A164s55	*Triticum aestivum /durum*	3	2.2	1.7
KH-P VA	KIN17A164s55	*Triticum aestivum /durum*	4.1	3	2.7
KH-P VA	KIN17C2851s76	*Triticum aestivum /durum*	4.5	3.5	2.8
KH-P VA	KIN17C2851s76	*Triticum aestivum /durum*	3.7	2.4	1.8
KH-P VA	KIN17C2845s73	*Triticum aestivum /durum*	5	3.9	2.6
KH-P VA	KIN17C2845s73	*Triticum aestivum /durum*	5.5	3	2
KH-P VA	KIN17C2845s73	*Triticum aestivum /durum*	3.7	3	2.6
KH-P VA	KIN17C2845s73	*Triticum aestivum /durum*	3.4	2.2	2
KH-P VA	KIN17C2845s73	*Triticum* sp	4.5	2	1.5
KH-P VA	KIN18C2524s23	*Triticum aestivum /durum*	4.6	2.7	2
KH-P VA	KIN18C2524s23	*Triticum aestivum /durum*	4.1	3	2.2
KH-P VA	KIN18C2524s23	*Triticum aestivum /durum*	5.2	3.1	2.5
KH-P VA	KIN18C2524s23	*Triticum* sp	4.5	2.2	1.8
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	4	2.6	2
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	4	2	1.6
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	5	4	3
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	3.6	2.5	1.8
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	5	2.6	2
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	5.5	3.8	3
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	4.8	3.6	2.5
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	5	3.2	2.6
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	3.8	1.9	2
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	5	3	2.6
KH-P VB	KIN18C3403s43	*Triticum aestivum /durum*	4.5	3.7	2.6
KH-P VB	KIN18C3402s42	*Triticum aestivum /durum*	4.4	2.6	2.1
KH-P VB	KIN18C3402s42	*Triticum aestivum /durum*	4.3	3	2.4
KH-P VB	KIN18C3402s42	*Triticum aestivum /durum*	4	2.1	1.5
KH-P VB	KIN18C3402s42	*Triticum aestivum /durum*	4.5	3	2.1
KH-P VB	KIN18C3402s42	*Triticum aestivum /durum*	5	2.8	2.2
KH-P VB	KIN18C2898s36	*Triticum aestivum /durum*	3.9	3	2.2
KH-P VB	KIN18C2898s36	*Triticum aestivum /durum*	4.6	3.1	2.6
KH-P VB	KIN18C2898s36	*Triticum aestivum /durum*	4.4	2	2
KH-P VB	KIN18C2897s35	*Triticum aestivum /durum*	5.2	3.6	3
KH-P VB	KIN18C2897s35	*Triticum aestivum /durum*	4	2.2	2
KH-P VB	KIN18C2897s35	*Triticum aestivum /durum*	4	2.6	2.2
KH-P VB	KIN18C2897s35	*Triticum aestivum /durum*	4	2.5	2.1
KH-P VB	KIN18C2897s35	*Triticum aestivum /durum*	5.6	3.4	2.6
KH-P VB	KIN18C2892s31	*Triticum aestivum /durum*	4.4	2.5	2.2
KH-P VB	KIN18C2890s30	*Triticum aestivum /durum*	4.2	2.3	2
KH-P VB	KIN18C2526s28	*Triticum aestivum /durum*	5	3.8	2.9
KH-P VB	KIN18C2526s28	*Triticum aestivum /durum*	5.2	3.4	2.3
KH-P VB	KIN18C2526s28	*Triticum aestivum /durum*	4.5	3.2	2.5
KH-P VI	KIN18C3410s44	*Triticum aestivum /durum*	5	3.5	3.1
KH-P VI	KIN18C3410s44	*Triticum aestivum /durum*	4.8	2.9	2.2
KH-P VI	KIN18C3410s44	*Triticum aestivum /durum*	4	3	3.7
KH-P VI	KIN18C3410s44	*Triticum aestivum /durum*	5.1	2.4	2.2
KH-P VI	KIN18C3410s44	*Triticum* sp	4.4	2.1	1.8
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	4	3	2.5

Period	**Sample**	**ID**	**L**	**B**	**H**
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	4.7	2.7	2.2
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	5.7	3	2.2
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	4.1	2.1	1.5
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	3.2	2.9	2.2
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	3.6	2.8	2.5
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	4	2.5	1.8
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	3	2.2	1.6
KH-P VI	KIN18C3411s49	*Triticum aestivum /durum*	3.6	1.8	1.6

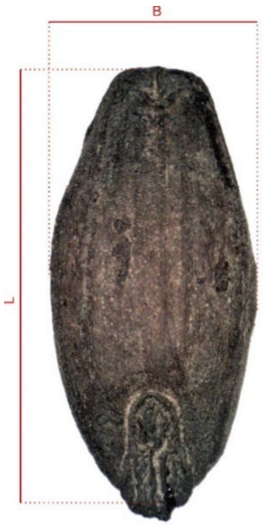
L = length

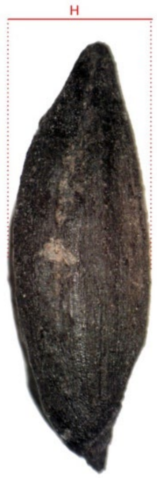
B = breadth

H = height

***Hordeum vulgare* caryopsis**

Period	Sample	L	B	H	straight/twisted
KH-P I	KIN15B2082s42	7	3.5	3	straight
KH-P I	KIN15B2082s42	4.5	2.5	1.7	straight
KH-P I	KIN15B2082s42	5	2.3	1.5	straight
KH-P I	KIN15B2082s42	6	3.7	3	straight
KH-P I	KIN13B617s26	4.8	3	2.2	straight
KH-P I	KIN13B617s26	5.5	3.4	2.7	straight
KH-P I	KIN13B617s26	6.5	4	3	straight
KH-P I	KIN13B617s26	6.5	3	2.5	straight
KH-P I	KIN13B617s26	5.8	3.1	2.2	straight
KH-P I	KIN13B633s45	4.9	2.8	2.2	straight
KH-P I	KIN13B633s45	4.8	2.4	1.9	nr
KH-P I	KIN13B608s39	6.6	3.6	3	straight
KH-P I	KIN13B608s39	7.7	3.8	2.6	straight
KH-P I	KIN13B608s39	7	2.7	2.5	twisted
KH-P I	KIN13B608s39	5.6	3.3	2.3	straight
KH-P I	KIN13B608s39	6.7	3.3	2.1	twisted
KH-P I	KIN12B488s18	5.4	3.2	2.5	straight
KH-P I	KIN16B502s13	5.6	2.9	2	straight
KH-P I	KIN16B2169s11	6.6	3.2	2.7	straight
KH-P I	KIN16B2169s11	7	2.7	2	twisted
KH-P I	KIN16B2169s11	5.2	2.2	1.8	straight
KH-P I	KIN16B2169s11	5.4	3	1.9	straight
KH-P I	KIN16B2169s11	5.5	3.3	2.5	nr
KH-P I	KIN16B2169s11	5.7	3.5	2.7	straight
KH-P I	KIN16B2169s11	5.5	3.5	2.8	straight
KH-P I	KIN13B644s67	5.5	3.2	2	straight
KH-P I	KIN13B644s67	5.5	2	2	straight
KH-P I	KIN13B644s67	5	3.4	2.5	straight
KH-P I	KIN13B644s67	6.1	3.8	2.5	straight
KH-P I	KIN13B644s67	5.7	3	2.2	straight
KH-P I	KIN13B644s67	6.3	3.4	2.8	straight
KH-P I	KIN13B644s67	5.4	2.7	2	straight
KH-P I	KIN13B644s67	6.2	3.2	2.8	nr
KH-P I	KIN13B644s67	6	3	2.5	straight
KH-P I	KIN13B644s67	5	3	2.2	straight
KH-P I	KIN13B644s67	7.3	3.5	2.4	straight
KH-P I	KIN13B644s67	6.6	3.8	3	nr
KH-P I	KIN13B644s67	4	2	1.4	straight
KH-P I	KIN12B520s93	5.8	3.4	2.5	straight
KH-P I	KIN12B522s96	5.4	2.5	1.5	straight
KH-P I	KIN12B522s96	6.5	3.4	2.8	straight
KH-P I	KIN12B522s96	6.6	3.2	2.5	nr
KH-P I	KIN12B522s96	6.3	3.5	2.6	straight
KH-P I	KIN12B522s96	6	3.3	2.6	straight
KH-P I	KIN12B522s96	6.2	3.5	3.1	straight
KH-P I	KIN12B522s96	6.5	3.2	2.8	straight
KH-P I	KIN12B522s96	7.1	3.6	2.5	straight
KH-P I	KIN12B522s96	6	3	2.5	straight
KH-P I	KIN12B522s96	6	2.9	2	straight
KH-P I	KIN12B522s96	6	3.3	3	straight





Period	Sample	L	B	H	straight/twisted
KH-P I	KIN12B522s96	6.2	3.2	3	straight
KH-P I	KIN12B522s96	5.5	3.4	2.7	straight
KH-P I	KIN12B522s96	6.3	3.5	2.6	straight
KH-P I	KIN12B522s96	6.8	3.5	3	straight
KH-P I	KIN12B522s96	5.9	3.5	2.7	straight
KH-P I	KIN12B522s96	6	3	2.8	straight
KH-P I	KIN13B762s122	6	2.9	2.2	straight
KH-P I	KIN13B789s155	6	3.4	2.5	straight
KH-P I	KIN13B789s155	6	3.7	3	straight
KH-P I	KIN13B789s155	6	3.2	2.2	straight
KH-P I	KIN12B540s130	6.8	3.5	3	straight
KH-P II	KIN13A972s304	7	3.9	3.2	straight
KH-P II	KIN13A972s304	5.7	3.4	2.1	straight
KH-P II	KIN13A972s304	7.8	3.5	3	nr
KH-P II	KIN13A972s304	6.5	2.8	2.4	straight
KH-P II	KIN13A972s304	5.8	3.5	2.8	nr
KH-P II	KIN13A972s304	6.3	2.8	2.1	straight
KH-P II	KIN13A972s304	5.5	3	1.8	nr
KH-P II	KIN13A972s304	5.5	3.5	2.4	nr
KH-P II	KIN13A972s304	7	3.1	2.2	nr
KH-P II	KIN13A972s304	6.5	3.5	3	straight
KH-P II	KIN13A972s304	4.5	2.7	2.2	straight
KH-P II	KIN13A972s304	5.6	2.5	1.5	nr
KH-P II	KIN13A972s304	5.6	2.4	2	twisted
KH-P II	KIN13A972s304	5	2.9	2.2	straight
KH-P II	KIN13A972s304	6	2.2	1.5	straight
KH-P II	KIN17A1830s12	6	3.4	2.7	straight
KH-P II	KIN13A146s61	6.5	3.6	3	straight
KH-P II	KIN14A1534s101	6.4	3.8	2.8	twisted
KH-P II	KIN14A1534s101	6.2	3.3	2.9	straight
KH-P II	KIN14A1534s101	6.1	3.2	2.8	straight
KH-P II	KIN14A1534s101	7	4	2.6	twisted
KH-P II	KIN14A1534s101	5	2.7	2.4	twisted
KH-P II	KIN14A1534s101	7	3.8	2.7	straight
KH-P II	KIN14A1534s101	6.5	3.9	3	straight
KH-P II	KIN12A237s238	6	3.2	2.8	straight
KH-P II	KIN12A237s238	5.7	3.3	2.4	twisted
KH-P II	KIN12A237s238	5	2.1	1.4	straight
KH-P II	KIN13A950s242	3.9	2.3	1.5	nr
KH-P II	KIN13A950s242	6.5	3.4	3.5	straight
KH-P II	KIN13A950s242	8	3	2.2	nr
KH-P II	KIN13A950s242	6	3.2	2.2	nr
KH-P II	KIN13A950s242	8	3.5	2.5	nr
KH-P II	KIN13A939s257	7	3.7	2.7	straight
KH-P II	KIN13A939s257	5.8	3.1	2.2	twisted
KH-P II	KIN13A939s257	6.7	3.7	2.6	twisted
KH-P II	KIN13A939s257	6.8	3.8	2	nr
KH-P II	KIN13A939s257	5	3	2.1	twisted
KH-P II	KIN13A939s257	5.3	3.2	2.2	nr
KH-P II	KIN13A939s257	6.5	3.6	2.2	straight
KH-P II	KIN13A939s257	8.2	3.4	2.6	twisted

Period	Sample	L	B	H	straight/twisted
KH-P II	KIN13A939s257	5.5	3.6	2.6	straight
KH-P II	KIN13A939s257	6	2.9	2.4	straight
KH-P II	KIN13A939s257	5.5	3	2.1	straight
KH-P II	KIN13A939s257	7.2	3.6	2.5	straight
KH-P II	KIN13A939s257	5.7	3.2	2.2	straight
KH-P II	KIN13A939s257	6.5	2.8	2.2	straight
KH-P II	KIN13A939s257	6	3.1	2.7	straight
KH-P II	KIN12A233s273	6	3.6	3	straight
KH-P II	KIN12A233s273	7	3.3	2.7	straight
KH-P II	KIN12A233s273	6	3	2.2	straight
KH-P II	KIN12A233s273	5.8	2.8	2.3	straight
KH-P II	KIN13A982s293	6.5	4	2.5	straight
KH-P II	KIN13A982s293	5	3.4	2.6	straight
KH-P II	KIN13A982s293	5.5	3.7	2.6	nr
KH-P II	KIN13A982s293	6	4	2.8	straight
KH-P II	KIN13A982s293	7.3	3.6	3	straight
KH-P II	KIN13A982s293	5.2	3	2.2	straight
KH-P II	KIN13A982s293	4	2.6	2.6	straight
KH-P II	KIN13A982s293	6	3.3	2.5	straight
KH-P II	KIN13A982s293	5.9	3.4	3.3	straight
KH-P II	KIN12B560s156	5.5	2.8	2	straight
KH-P II	KIN12B560s156	5.8	2.8	2.2	straight
KH-P II	KIN12B560s156	4.6	2.2	1.6	straight
KH-P II	KIN12B549s138	5.5	3.1	2.5	straight
KH-P II	KIN12B549s138	6	3	2.2	twisted
KH-P II	KIN12B549s138	6	3	2.5	nr
KH-P II	KIN12B549s138	6.5	3.4	2.6	straight
KH-P II	KIN16B2181s34	5.5	2.9	2	straight
KH-P II	KIN16B2181s34	5	2.7	2	straight
KH-P II	KIN16B2196s59	6	3.4	2.6	straight
KH-P II	KIN16B2196s59	4.7	2.9	1.5	straight
KH-P II	KIN15B2107s86	5.8	2.8	2.1	twisted
KH-P II	KIN15B2107s86	6.6	3.3	2	twisted
KH-P II	KIN15B2113s108	6.2	3.4	2.8	straight
KH-P II	KIN15B2113s108	nr	2.6	2.2	straight
KH-P II	KIN15B2113s108	5.2	2.9	2.5	straight
KH-P II	KIN15B2113s108	nr	2.2	1.2	straight
KH-P II	KIN15B2111s116	7.2	3	2	straight
KH-P II	KIN14B2018s120	5.5	2.6	2	straight
KH-P II	KIN14B2018s120	5	3	2.2	straight
KH-P II	KIN14B2018s120	5.7	3.7	3.6	straight
KH-P II	KIN16B2221s116	2.8	3.3	2.5	straight
KH-P II	KIN16B2221s116	6.5	3.5	3	twisted
KH-P II	KIN16B2221s116	6.5	4	3	straight
KH-P II	KIN16B2221s116	6.8	3.8	2.8	straight
KH-P II	KIN16B2221s116	6	2	1.8	straight
KH-P II	KIN16B2221s116	6.8	3.3	3	straight
KH-P II	KIN16B2221s116	6.6	3.8	3	straight
KH-P II	KIN16B2221s116	6.4	3.5	2.8	straight
KH-P II	KIN16B2221s116	5.2	3.2	2.5	straight
KH-P II	KIN16B2221s116	7.2	3.2	3	straight

Period	Sample	L	B	H	straight/twisted
KH-P II	KIN16B2221s116	6	2.8	2.2	straight
KH-P II	KIN16B2221s116	6.5	3.8	2	straight
KH-P II	KIN16B2221s116	7.2	3.4	2.5	straight
KH-P II	KIN16B2221s116	6	2.8	2.1	straight
KH-P II	KIN16B2221s116	6.8	4	3.4	straight
KH-P II	KIN16B2221s116	4.8	2.2	1.5	straight
KH-P II	KIN16B2221s116	6	2.8	2.1	straight
KH-P II	KIN16B2221s116	5.7	2.5	1.8	straight
KH-P II	KIN16B2221s116	5.2	2.1	1.5	straight
KH-P II	KIN16B2221s116	5.8	3	2.2	straight
KH-P II	KIN13B565s126	5.5	3	2.5	straight
KH-P II	KIN13B565s126	4.9	2.4	1.9	straight
KH-P II	KIN13B565s126	6	3.3	3	twisted
KH-P II	KIN14B2031s133	7.5	3.7	3.3	straight
KH-P II	KIN14B2031s133	5.9	3	2.2	straight
KH-P II	KIN14B2031s133	6.5	3.3	1.8	straight
KH-P II	KIN14B2032s135a	4.8	2.8	1.9	straight
KH-P III	KIN13A175s117	6.7	2.6	2	straight
KH-P III	KIN17A1790s135	5.5	3	2.4	straight
KH-P III	KIN17A1790s135	5.5	3	2.2	twisted
KH-P III	KIN17A1790s135	6.5	3	2	nr
KH-P III	KIN17A1790s135	7	3.5	3	straight
KH-P III	KIN17A1893s149	5.7	3.2	2.3	nr
KH-P III	KIN17A1893s149	5.8	3.4	2.5	straight
KH-P III	KIN17A1893s149	5.5	2.5	1.5	straight
KH-P III	KIN17A1893s149	6	3.6	3	straight
KH-P III	KIN17A1893s149	4.5	3.1	2	straight
KH-P III	KIN17A1893s149	5.7	4	2.3	straight
KH-P III	KIN17A1893s149	5.8	2.1	1.5	straight
KH-P III	KIN17A1893s149	5.5	2.8	2.2	straight
KH-P III	KIN17A1893s149	7	3.5	2.5	straight
KH-P III	KIN17A1893s149	6.3	3.3	2.5	straight
KH-P III	KIN17A1893s149	6.6	3.1	2.2	straight
KH-P III	KIN17A1893s149	4	2.1	1.6	straight
KH-P III	KIN17A1893s149	6	3.5	2.5	straight
KH-P III	KIN17A1893s149	5	3.1	1.6	straight
KH-P III	KIN17A1893s149	6.7	3.2	2	straight
KH-P III	KIN17A1893s149	4.5	2.8	2	straight
KH-P III	KIN17A1894s157	6.6	3.1	2.1	straight
KH-P III	KIN17A1894s157	8	3.5	3	straight
KH-P III	KIN17A1894s157	6	3.2	1.5	straight
KH-P III	KIN17A1894s157	5.5	2.5	2	straight
KH-P III	KIN17A1894s157	5.8	3.3	2.6	straight
KH-P III	KIN17A1894s157	5.8	2.8	2.2	straight
KH-P III	KIN17A1894s157	6.6	3.2	2.5	straight
KH-P III	KIN17A1894s157	5.6	3.5	2.2	nr
KH-P III	KIN17A1894s157	6.5	3	2.5	twisted
KH-P III	KIN17A1894s157	6	3	2	straight
KH-P III	KIN17A1894s157	5	2.8	2	straight
KH-P III	KIN17A1894s157	6.5	2.5	1.6	straight
KH-P III	KIN17A1894s157	6.5	3	2.5	straight

Period	Sample	L	B	H	straight/twisted
KH-P III	KIN17A1894s157	6.4	3.3	2.5	straight
KH-P III	KIN17A1894s157	6.2	3.1	2.5	straight
KH-P III	KIN17A1894s157	5.8	3	2	straight
KH-P III	KIN17A1894s157	6.4	3.5	3	straight
KH-P III	KIN17A1894s157	6	3.7	2.6	straight
KH-P III	KIN17A1894s157	6	3.1	2	straight
KH-P III	KIN17A1894s157	6.3	3.5	2.5	straight
KH-P III	KIN17A1894s157	6.1	3	2	straight
KH-P III	KIN17A1894s157	6.2	3.3	2	nr
KH-P III	KIN17A1894s157	5.5	3	2.4	nr
KH-P III	KIN17A1894s157	5.7	3	3	nr
KH-P III	KIN17A1894s157	7	3	2.4	straight
KH-P III	KIN17A1894s157	6	3.2	2.5	straight
KH-P III	KIN17A1894s157	6.5	3.8	2.7	straight
KH-P III	KIN17A1894s157	5.6	3.5	2.4	straight
KH-P III	KIN17A1894s157	5.5	3	2	straight
KH-P III	KIN17A1894s157	5	3.2	2.3	straight
KH-P III	KIN17A1894s157	5.5	3.5	2.4	straight
KH-P III	KIN17A1894s157	6.5	3.2	2.4	straight
KH-P III	KIN17A1894s157	6	3	2.5	straight
KH-P III	KIN17A1894s157	5.5	4	2.5	straight
KH-P III	KIN17A1894s157	6	3.5	3	twisted
KH-P III	KIN17A1894s157	6.2	3.5	2.2	twisted
KH-P III	KIN17A1894s157	6	3	2.2	twisted
KH-P III	KIN17A1894s157	6	4	2.8	twisted
KH-P III	KIN17A1894s157	5.2	3	5.2	twisted
KH-P III	KIN17A1894s157	6.7	3.5	2.5	twisted
KH-P III	KIN17A1894s157	6.5	2.5	2.8	twisted
KH-P III	KIN17A1894s157	6	3.4	2.5	twisted
KH-P III	KIN17A1894s157	6.2	3	2.8	twisted
KH-P III	KIN17A1894s157	5.5	3	2.5	twisted
KH-P III	KIN17A1894s158	6	3.2	2.3	straight
KH-P III	KIN17A1894s158	5.5	3.1	2.3	nr
KH-P III	KIN17A1894s158	5.2	3.4	2.4	straight
KH-P III	KIN17A1894s158	6	3.5	2.5	straight
KH-P III	KIN17A1894s158	6.4	2.7	1.9	straight
KH-P III	KIN17A1894s158	6	3.2	2.5	straight
KH-P III	KIN17A1894s158	4.4	2.5	2	straight
KH-P III	KIN18A1902s4	5.8	3.2	2.6	nr
KH-P III	KIN18A1902s4	6.2	3.1	2.2	straight
KH-P III	KIN18A1902s4	6.3	3.5	2.6	twisted
KH-P III	KIN18A1902s4	5.5	2.8	2.2	straight
KH-P III	KIN18A1902s4	4.5	2.4	1.6	straight
KH-P III	KIN18A1902s4	5.8	3.3	2.5	straight
KH-P III	KIN16A1683s4	6.5	3	2.5	straight
KH-P III	KIN16A1721s55	5.9	3.8	2.5	straight
KH-P III	KIN16A1721s55	5	2.8	1.8	twisted
KH-P III	KIN17A1771s65	6.4	3.2	2.7	straight
KH-P III	KIN17A1771s61	6	3.5	3	straight
KH-P III	KIN16A1711s67	6.2	3.2	2.2	straight
KH-P III	KIN16A1711s67	6.5	3.4	2.7	straight

Period	Sample	L	B	H	straight/twisted
KH-P III	KIN18A1996s91	5.5	2.8	2.2	straight
KH-P III	KIN18A1996s91	6	3.3	2.5	straight
KH-P III	KIN18A1996s91	5.9	3.5	2.6	straight
KH-P III	KIN14B807s38a	6.8	3.5	2.2	straight
KH-P III	KIN14B807s38a	5.9	3.4	3	straight
KH-P III	KIN14B807s38a	6	3.1	2.8	straight
KH-P III	KIN14B807s38a	5	2.5	1.5	straight
KH-P III	KIN14B807s38a	5.5	3.5	2.8	straight
KH-P III	KIN14B807s38b	6.2	3.5	2.5	straight
KH-P III	KIN14B807s38b	6.2	3.5	2.5	straight
KH-P III	KIN14B807s38b	6.2	3.5	2.5	straight
KH-P III	KIN14B899s91	5.5	3.5	2	straight
KH-P III	KIN14B899s91	6	3.4	2.5	straight
KH-P III	KIN14B899s91	6	3.5	2	straight
KH-P III	KIN14B899s91	6	2.4	1.6	straight
KH-P III	KIN14B899s91	6.2	3.2	2.6	straight
KH-P III	KIN14B899s91	6	3.3	2.8	straight
KH-P III	KIN14B2002s106	7.2	2.3	1.2	straight
KH-P III	KIN14B2002s106	6.2	3.3	2	twisted
KH-P III	KIN14B2002s106	5.2	2.3	1.7	straight
KH-P III	KIN14B2002s106	6.7	3.1	2.5	straight
KH-P III	KIN14B2002s106	6.7	3.1	2.5	straight
KH-P III	KIN14B2002s106	6.8	3	1.4	straight
KH-P III	KIN14B2002s106	5.9	2.8	2.2	straight
KH-P III	KIN14B2002s106	5.8	2.2	1.9	straight
KH-P III	KIN14B2002s106	6.3	3	2.3	straight
KH-P III	KIN14B2002s106	4.9	1.9	1.5	twisted
KH-P III	KIN14B2002s106	5.5	2.8	1.9	straight
KH-P III	KIN14B2002s106	4.6	2.1	1.4	straight
KH-P III	KIN14B2002s106	5.4	2.6	2	straight
KH-P III	KIN14B2002s106	6.4	2.8	2.2	straight
KH-P III	KIN14B2002s106	6	2.6	1.9	straight
KH-P III	KIN14B2002s106	5.9	2.1	1.5	straight
KH-P III	KIN14B2002s106	6.3	3.4	2.6	straight
KH-P III	KIN14B2002s106	6	3.5	2.8	nr
KH-P III	KIN14B2002s106	6.4	3.2	2.4	straight
KH-P III	KIN14B2002s106	6	3.2	2.5	straight
KH-P III	KIN14B2002s106	6.4	3.5	2.4	straight
KH-P III	KIN14B2002s106	6.5	3.4	2.5	twisted
KH-P III	KIN14B2002s106	6.5	3.7	2.5	straight
KH-P III	KIN14B2002s106	5.5	3.2	2.5	straight
KH-P III	KIN14B2002s106	5	2.7	1.5	twisted
KH-P III	KIN14B2002s106b	5.5	2.9	2	straight
KH-P III	KIN14B2002s106b	5.5	2.8	2.4	straight
KH-P III	KIN14B2002s106b	6	2.2	1.9	straight
KH-P III	KIN14B2002s106b	5	2.4	1.8	straight
KH-P III	KIN14B2002s106b	5.4	3.2	2.5	straight
KH-P III	KIN14B2002s106b	5.5	2.9	2	straight
KH-P III	KIN14B2002s106b	5.5	3	2.4	straight
KH-P III	KIN14B2002s106b	5	2.4	1.6	straight
KH-P III	KIN14B2002s106b	5.7	3.2	2.4	straight

Period	Sample	L	B	H	straight/twisted
KH-P III	KIN14B876s115	6	3.2	2.5	straight
KH-P III	KIN14B807s125	6.8	3.4	2.7	straight
KH-P III	KIN14B807s125	6	2.8	2.2	straight
KH-P III	KIN14B807s125	6.2	2.9	2	straight
KH-P III	KIN14B807s125	6.8	3.8	2.8	twisted
KH-P III	KIN14B807s125	6	3	2.4	straight
KH-P III	KIN14B807s125	7.7	2.8	2.1	straight
KH-P III	KIN14B807s125	6.6	4	2.2	nr
KH-P III	KIN14B807s125	4.5	3	2.5	straight
KH-P III	KIN14B807s125	6.2	3	2.5	straight
KH-P III	KIN14B807s125	5.5	2.5	2.3	nr
KH-P III	KIN14B807s125	4.4	2.2	2	nr
KH-P III	KIN14B807s125	6	3.2	2.8	straight
KH-P III	KIN14B807s125	6.5	3.5	2.8	straight
KH-P III	KIN14B807s125	4.8	2.3	1.3	nr
KH-P III	KIN13B802s162	7.5	4	3	nr
KH-P III	KIN13B804s167	6.3	3	1.8	straight
KH-P III	KIN13B804s167	6	3.5	2.1	straight
KH-P III	KIN13B804s167	6.2	3.2	2.5	straight
KH-P III	KIN13B804s167	6.8	3.2	2.2	straight
KH-P III	KIN13B804s167	5.5	3.2	2	straight
KH-P III	KIN13B804s167	6	3.3	2.7	straight
KH-P III	KIN13B807s175	7.5	3	1.7	straight
KH-P III	KIN13B807s175	7	3.8	2.9	straight
KH-P III	KIN13B807s175	5.8	2.5	1.9	straight
KH-P III	KIN13B807s175	5.5	2.2	2	straight
KH-P III	KIN13B807s175	6.5	3.3	2.5	straight
KH-P III	KIN13B807s175	5.5	3	2.2	straight
KH-P III	KIN13B807s175	6.3	3.2	2.6	straight
KH-P III	KIN13B807s175	5.2	2.8	2.2	twisted
KH-P III	KIN13B807s175	6.1	4.1	2.5	nr
KH-P III	KIN13B807s175	5.5	3.5	2.8	nr
KH-P III	KIN16D2416s37	6.8	4.1	3.4	straight
KH-P III	KIN16D2416s37	5.8	2.7	2.3	straight
KH-P III	KIN16D2416s37	6.5	2.2	1.8	straight
KH-P III	KIN16D2416s37	4.6	2.1	1.5	straight
KH-P III	KIN16D2416s37	4.4	1.9	1.5	straight
KH-P III	KIN14D1155s20	6.4	3.3	2.4	straight
KH-P III	KIN14D1155s20	6.2	2.9	2.4	straight
KH-P III	KIN14D1155s20	5.5	3	2.5	straight
KH-P III	KIN14D1155s20	5.9	3.2	2.2	straight
KH-P III	KIN14D1155s20	6	2.8	2.2	straight
KH-P III	KIN13D1144s185	6	3	2	straight
KH-P III	KIN13D1144s185	5	2	1.7	straight
KH-P III	KIN14D2385s150	6.4	3.2	2.3	twisted
KH-P III	KIN14D2385s150	4.9	2.5	1.8	straight
KH-P III	KIN14D2314s140	6.8	3	2.5	straight
KH-P III	KIN14D2314s140	6.3	3.6	2.5	straight
KH-P III	KIN14D2314s140	5.5	2.3	1.2	straight
KH-P III	KIN15D2379s117	7.5	3.6	2.2	nr
KH-P III	KIN15D2379s117	5.8	2.8	2.2	straight

Period	Sample	L	B	H	straight/twisted
KH-P III	KIN15D2379s117	7	3.3	2.4	straight
KH-P III	KIN15D2379s117	5.4	2.5	1.6	straight
KH-P III	KIN14D2302s102	5.5	2.9	2	straight
KH-P III	KIN14D1192s101	5.4	2.1	1.4	straight
KH-P III	KIN14D1192s101	5.4	3.2	2	nr
KH-P III	KIN14D1192s101	5.5	3	1.8	straight
KH-P III	KIN14D1109s95	6.2	3	2	straight
KH-P III	KIN14D1109s95	6	3.3	2.5	straight
KH-P III	KIN14D1109s95	5	2.9	2.1	straight
KH-P III	KIN14D1109s95	4.5	2.7	1.9	straight
KH-P III	KIN15D2313s74	6	2.8	2	twisted
KH-P III	KIN14D1149s73	5	3.4	2.2	straight
KH-P III	KIN14D1149s73	5.1	2.8	2.2	straight
KH-P III	KIN15D2348s38	6.6	3.2	2.6	twisted
KH-P III	KIN15D2348s38	7.7	3.5	3.2	straight
KH-P III	KIN15D2348s38	6	2.9	2.5	twisted
KH-P III	KIN15D2348s38	6.5	2.9	2.1	straight
KH-P III	KIN15D2348s38	7	3.4	2.1	straight
KH-P III	KIN15D2348s38	6.5	3.4	3	straight
KH-P III	KIN15D2348s38	7	3.7	2.5	twisted
KH-P III	KIN15D2348s38	6.5	3.4	2.2	twisted
KH-P III	KIN15D2348s38	6	3	2.5	twisted
KH-P III	KIN15D2348s38	5.5	2.1	1.3	nr
KH-P III	KIN14D1166s52a	5.2	3	2.5	straight
KH-P IV	KIN18A1397s36	5.5	3	2.7	twisted
KH-P IV	KIN18A1397s36	6	3.5	2.5	twisted
KH-P IV	KIN18A1379s31	6	2.5	2	straight
KH-P IV	KIN18A1379s31	5.5	2.7	2	straight
KH-P IV	KIN18A1379s31	4.6	2.1	1.5	nr
KH-P IV	KIN18A1379s31	5	2.7	2	straight
KH-P IV	KIN18A1379s31	5.3	2.9	2.1	straight
KH-P IV	KIN18A1379s31	5.1	3.1	2.5	twisted
KH-P IV	KIN18A1379s31	4.8	2.5	1.8	straight
KH-P IV	KIN18A1379s31	4.8	2.8	2	nr
KH-P IV	KIN18A1379s31	5.2	2.8	2	nr
KH-P IV	KIN18A1379s31	5	2.4	1.8	straight
KH-P IV	KIN18A1379s31	5.8	2.7	2.8	straight
KH-P IV	KIN18A1379s31	5	2.5	1.9	straight
KH-P IV	KIN18A1379s31	6	3.2	2.5	twisted
KH-P IV	KIN18A1379s31	5	2.4	1.9	straight
KH-P IV	KIN18A1379s31	6	2.8	2	straight
KH-P IV	KIN18A1379s31	5	2.2	1.1	straight
KH-P IV	KIN18A1379s31	4.6	2.5	1.7	straight
KH-P IV	KIN18A1379s31	4.8	2.5	2.2	twisted
KH-P IV	KIN18A1379s31	5.7	3.1	2.2	straight
KH-P IV	KIN18A1379s31	4.2	2.2	1.5	twisted
KH-P IV	KIN18A1379s31	4.9	2.5	2	straight
KH-P IV	KIN18A1379s31	5.3	2.5	2	straight
KH-P IV	KIN18A1379s31	5	2.5	1.9	straight
KH-P IV	KIN18A1379s31	5.5	2.6	2	straight
KH-P IV	KIN18A1377s3	6	2.8	1.5	straight

Period	Sample	L	B	H	straight/twisted
KH-P IV	KIN18A1377s3	6.5	3.5	2.5	straight
KH-P IV	KIN18A1377s3	6.1	3	2.2	straight
KH-P IV	KIN18A1377s3	7.3	3.5	2.5	straight
KH-P IV	KIN18A1377s3	5.5	3	2.4	straight
KH-P IV	KIN18A1377s3	6	4	2.8	straight
KH-P IV	KIN18A1377s3	5.2	2.9	2.2	straight
KH-P IV	KIN18A1377s3	4.8	3	2.2	nr
KH-P IV	KIN18A1377s3	5.5	3.5	2.5	nr
KH-P IV	KIN18A1377s3	6	3.3	2.2	straight
KH-P IV	KIN18A1377s3	5.6	3.2	2	straight
KH-P IV	KIN12A291s313	5.4	2.8	2	twisted
KH-P IV	KIN12A291s313	6	2.2	2	straight
KH-P IV	KIN12A291s313	5.8	2.9	2.2	straight
KH-P IV	KIN12A291s313	6	3	2.3	twisted
KH-P IV	KIN12A291s313	5	2.5	1.7	nr
KH-P IV	KIN17C2853s81	5.8	2.8	1.6	straight
KH-P IV	KIN17C2853s81	6	3	1.8	straight
KH-P IV	KIN17C2853s81	6.2	3	2.1	straight
KH-P IV	KIN17C2841s67	5.5	2.9	2.1	twisted
KH-P IV	KIN17C2841s67	5.8	3.1	2.5	straight
KH-P IV	KIN17C2841s67	5	2.3	1.4	straight
KH-P IV	KIN17C2841s67	5.3	2.5	2	nr
KH-P IV	KIN17C2841s67	5.4	3.1	2.6	straight
KH-P IV	KIN17C2841s67	5.7	3.5	2.6	straight
KH-P IV	KIN17C665s63	5.3	2.8	2.1	straight
KH-P IV	KIN17C665s63	6	2.8	2.4	straight
KH-P IV	KIN17C665s63	5.5	2.6	2	twisted
KH-P IV	KIN17C665s63	5.5	2.2	1.2	nr
KH-P IV	KIN17C665s63	6	3.4	2.7	straight
KH-P IV	KIN17C665s63	6.4	3.4	2.5	straight
KH-P IV	KIN17C2838s61	5.1	3.1	2.5	straight
KH-P IV	KIN17C2838s61	5.2	2.4	1.6	twisted
KH-P IV	KIN17C2838s61	5.7	3	2	straight
KH-P IV	KIN17C2830s40	5.5	3.6	2.6	straight
KH-P IV	KIN17C2830s40	5.5	3	2	twisted
KH-P IV	KIN17C2830s40	5.5	3.6	2.6	straight
KH-P IV	KIN17C2830s40	5.5	3	2	twisted
KH-P IV	KIN16C2659s47	5.8	3	2.8	straight
KH-P IV	KIN16C2659s47	6.4	3.4	2.5	nr
KH-P IV	KIN17C2833s47	6.4	3.3	2.4	nr
KH-P IV	KIN17C2833s47	5.2	2.8	2.5	nr
KH-P IV	KIN17C2833s47	4.8	2	1.5	straight
KH-P IV	KIN17C2833s47	nr	2.3	1.5	straight
KH-P IV	KIN17C2833s47	5.8	2.7	1.9	straight
KH-P IV	KIN17C2833s47	5	2.8	2.4	straight
KH-P IV	KIN17C2833s47	5	2.9	3.2	nr
KH-P IV	KIN17C2833s47	4.2	2	1.2	straight
KH-P IV	KIN17C2833s47	4.9	2.2	1.4	straight
KH-P IV	KIN17C2833s47	4.5	2	1.6	twisted
KH-P IV	KIN17C2834s51	6.4	3.5	2.5	straight
KH-P IV	KIN17C2834s51	6	3.7	2.5	nr

Period	Sample	L	B	H	straight/twisted
KH-P IV	KIN17C2834s51	5.7	3	2	nr
KH-P IV	KIN17C2834s51	4.6	2.6	1.5	nr
KH-P IV	KIN17C2837s56	7	2.1	1.5	straight
KH-P IV	KIN17C2837s56	6.5	3	1.7	straight
KH-P IV	KIN17C2837s56	5.4	2.8	2.2	straight
KH-P IV	KIN17C2837s56	5	2.4	1.5	twisted
KH-P IV	KIN18C2870s15	5.1	2.9	2	straight
KH-P IV	KIN18C2870s15	5.5	3.1	2.8	straight
KH-P IV	KIN18C2870s15	6.8	3.1	2.7	straight
KH-P IV	KIN18C2870s15	6.4	3.1	2.4	straight
KH-P IV	KIN18C2870s15	5.5	3	3.1	straight
KH-P IV	KIN17C2811s32	5.5	3	2	nr
KH-P IV	KIN17C2811s32	6	3	2.5	nr
KH-P IV	KIN17C2811s32	4.5	2.5	1.5	straight
KH-P IV	KIN17C2825s38	5	2.1	1	straight
KH-P IV	KIN17C2812s39	6	3	2.5	straight
KH-P IV	KIN17C2812s39	5.8	3.2	2.8	straight
KH-P IV	KIN17C2812s39	6	3.3	2.2	straight
KH-P IV	KIN17C2812s39	5	2.5	2	straight
KH-P IV	KIN17C2812s39	4.8	2.9	2	straight
KH-P IV	KIN18C2874s5	6	3	2.5	twisted
KH-P IV	KIN18C2874s5	6.3	3.2	2	twisted
KH-P IV	KIN18C2874s5	5.6	3.5	2	twisted
KH-P IV	KIN18C2874s5	6.4	4.4	3	straight
KH-P IV	KIN18C2874s5	6.8	3.5	2.4	straight
KH-P IV	KIN18C2874s5	5.7	3.3	2.9	straight
KH-P IV	KIN18C2874s5	5.4	3.3	2.5	straight
KH-P IV	KIN18C2874s5	7.2	3.8	3.2	straight
KH-P IV	KIN18C2874s5	5.4	2.7	2	straight
KH-P IV	KIN18C2874s5	6.5	3.2	2.7	straight
KH-P IV	KIN18C2874s5	5.2	3.2	2.2	straight
KH-P IV	KIN18C2874s5	6.4	3.3	2.1	straight
KH-P IV	KIN18C2874s5	6.8	3.3	2.6	nr
KH-P IV	KIN18C2874s5	5.3	3.5	2.8	straight
KH-P IV	KIN18C2874s5	7.3	3.7	2.5	straight
KH-P IV	KIN18C2874s5	6.5	3.5	2.6	straight
KH-P IV	KIN18C2874s5	5.8	3.5	3.5	straight
KH-P IV	KIN18C2874s5	6.8	3.8	3	straight
KH-P IV	KIN18C2874s5	6.5	4.5	3	straight
KH-P IV	KIN18C2874s5	5.5	3.2	2.2	straight
KH-P IV	KIN18C2874s5	6.3	3.4	2.8	straight
KH-P IV	KIN18C2874s5	6	3.5	2.5	straight
KH-P IV	KIN18C2874s5	6	3.5	2.2	straight
KH-P IV	KIN18C2874s5	5.5	3	2.3	nr
KH-P IV	KIN18C2874s5	5.1	2.6	1.7	nr
KH-P IV	KIN18C2874s5	5.5	3.5	2.8	straight
KH-P IV	KIN18C2874s5	6	3.3	2.4	straight
KH-P IV	KIN15C2520s11	6.4	3.8	2.8	twisted
KH-P IV	KIN15C2520s11	5.5	3.2	2.4	straight
KH-P IV	KIN15C2520s11	6.7	3.4	2.4	straight
KH-P IV	KIN15C2520s11	5.5	3.3	2.8	nr

Period	Sample	L	B	H	straight/twisted
KH-P IV	KIN15C2520s11	5.9	3.2	2.3	nr
KH-P IV	KIN15C2520s11	5.6	2.6	1.4	straight
KH-P IV	KIN15C2520s11	4.7	2.3	1.2	straight
KH-P IV	KIN15C2520s11	6	2.8	1.9	straight
KH-P IV	KIN15C2520s11	5.5	2.8	2.8	straight
KH-P IV	KIN15C2520s11	5.8	2.9	2	straight
KH-P IV	KIN17C2683s13	5.8	3.2	2.5	straight
KH-P IV	KIN17C2683s13	6	2.5	1.7	straight
KH-P IV	KIN17C2683s13	5	2.7	2	straight
KH-P IV	KIN17C2683s13	4.2	2.2	1.6	straight
KH-P VA	KIN17A1402s4	5	2.3	1	straight
KH-P VA	KIN17A1402s4	6.5	3.1	2	straight
KH-P VA	KIN17A1402s4	6.6	2.8	2.5	straight
KH-P VA	KIN17A1402s4	6.7	2.7	2	twisted
KH-P VA	KIN17A1406s17	6.5	3	2.2	straight
KH-P VA	KIN17A1406s17	5.2	3.2	2.2	straight
KH-P VA	KIN17A1406s17	6	3.5	2	straight
KH-P VA	KIN17A1406s17	7.5	3.4	2	straight
KH-P VA	KIN17A1406s17	7.2	3.2	2.5	straight
KH-P VA	KIN17A1406s17	6.5	3.5	2	twisted
KH-P VA	KIN17A1406s17	6.5	3.6	2	nr
KH-P VA	KIN17A164s26	6.5	2.9	2	straight
KH-P VA	KIN17A164s26	6.4	2.3	2.6	nr
KH-P VA	KIN14A153s32	6.2	3.1	2.5	twisted
KH-P VA	KIN14A153s32	6	2.8	2	straight
KH-P VA	KIN14A153s32	5.8	2.8	2.1	straight
KH-P VA	KIN14A153s32	6	2.7	2.1	twisted
KH-P VA	KIN14A153s32	5	2.1	1.8	straight
KH-P VA	KIN14A153s32	5.8	2.5	1.6	straight
KH-P VA	KIN14A153s32	6	2.7	2.2	straight
KH-P VA	KIN14A153s32	6.5	3.2	3.2	twisted
KH-P VA	KIN14A153s32	5.5	2.9	2.1	twisted
KH-P VA	KIN14A153s32	6.1	3.5	3.1	nr
KH-P VA	KIN14A153s32	5	2.5	1.8	straight
KH-P VA	KIN14A153s32	6.7	2.9	2.5	straight
KH-P VA	KIN14A153s32	4.8	2.6	2	straight
KH-P VA	KIN14A153s32	6.5	4.6	2.6	straight
KH-P VA	KIN14A153s32	4.7	2.1	1.8	straight
KH-P VA	KIN14A153s32	5.7	3.5	2.6	straight
KH-P VA	KIN14A153s32	6.8	3.3	2.5	straight
KH-P VA	KIN14A153s32	5.5	3.1	2.5	straight
KH-P VA	KIN14A153s32	4.1	1.9	1.5	straight
KH-P VA	KIN14A153s32	5.7	2.5	1.9	straight
KH-P VA	KIN14A153s32	4.4	2.5	2.5	straight
KH-P VA	KIN14A153s32	6.5	3.3	2.8	twisted
KH-P VA	KIN14A153s32	5.9	3.1	2.5	twisted
KH-P VA	KIN14A153s32	4	2.5	2.4	straight
KH-P VA	KIN14A153s32	5.2	1.9	1.5	straight
KH-P VA	KIN14A153s32	7.5	4.2	3.8	twisted
KH-P VA	KIN17A1410s34	4.7	2.1	1	straight
KH-P VA	KIN17A1410s34	6	3.5	2.5	straight

Period	Sample	L	B	H	straight/twisted
KH-P VA	KIN17A164s55	7	3	2	twisted
KH-P VA	KIN17A164s55	7	3	2.7	twisted
KH-P VA	KIN17A164s55	5.7	236	2.3	nr
KH-P VA	KIN17C2851s76	5.7	3.1	2.5	twisted
KH-P VA	KIN17C2851s76	6	3	2.4	straight
KH-P VA	KIN17C2851s76	6	3.2	2.5	straight
KH-P VA	KIN17C2845s73	5.9	2.7	1.8	straight
KH-P VA	KIN17C2845s73	6.5	3.5	2.4	straight
KH-P VA	KIN17C2845s73	6.5	3.5	2.6	nr
KH-P VA	KIN17C2845s73	6.4	3.2	2.5	straight
KH-P VA	KIN17C2845s73	6	3.4	2.5	straight
KH-P VA	KIN17C2845s73	6.2	2.4	1.6	straight
KH-P VA	KIN17C2845s73	5	1.4	1	nr
KH-P VA	KIN18C2524s23	7	3.7	2.5	twisted
KH-P VA	KIN18C2524s23	4	2.5	2	straight
KH-P VA	KIN18C2524s23	6.5	4.7	2.5	nr
KH-P VB	KIN18C3403s43	7.4	3.4	2.7	straight
KH-P VB	KIN18C3403s43	6.1	3.4	2.5	straight
KH-P VB	KIN18C3403s43	7.1	3.5	2.2	twisted
KH-P VB	KIN18C3403s43	6.1	3.5	2.6	straight
KH-P VB	KIN18C3403s43	5	2.3	1.9	straight
KH-P VB	KIN18C3403s43	6.6	3.5	3	nr
KH-P VB	KIN18C3403s43	7.4	4	3	straight
KH-P VB	KIN18C3403s43	7	3.8	3	straight
KH-P VB	KIN18C3403s43	5	2.3	1.6	straight
KH-P VB	KIN18C3403s43	5.5	3.4	2.5	nr
KH-P VB	KIN18C3402s42	5.5	2.3	1.6	straight
KH-P VB	KIN18C3402s42	6.4	3.2	2.6	straight
KH-P VB	KIN18C3402s42	6.1	2.9	2.5	nr
KH-P VB	KIN18C3402s42	6	2.6	1.9	straight
KH-P VB	KIN18C3402s42	5.5	2.7	2.4	straight
KH-P VB	KIN18C3402s42	6.5	3.2	2.9	nr
KH-P VB	KIN18C3402s42	5	2.6	2	twisted
KH-P VB	KIN18C3402s42	7	4.3	2.9	twisted
KH-P VB	KIN18C2898s36	6	3.6	2.8	straight
KH-P VB	KIN18C2898s36	6.5	2.9	2.4	nr
KH-P VB	KIN18C2898s36	4.8	2.2	1.5	straight
KH-P VB	KIN18C2897s35	6.5	3.4	2.2	nr
KH-P VB	KIN18C2897s35	6.2	2.5	1.5	straight
KH-P VB	KIN18C2897s35	5.5	3.8	3	straight
KH-P VB	KIN18C2897s35	6.4	3.5	2.5	twisted
KH-P VB	KIN18C2897s35	5	2.5	2.1	nr
KH-P VB	KIN18C2892s31	6.6	3.6	2.5	twisted
KH-P VB	KIN18C2892s31	6.5	3	2	nr
KH-P VB	KIN18C2892s31	7	3.4	2.5	twisted
KH-P VB	KIN18C2892s31	6.5	2.8	2.4	straight
KH-P VB	KIN18C2890s30	7.5	4.2	3.2	nr
KH-P VB	KIN18C2890s30	7.5	3	2.2	straight
KH-P VB	KIN18C2890s30	5.5	3.4	2.2	nr
KH-P VB	KIN18C2526s28	6.5	3.6	2.5	straight
KH-P VB	KIN18C2526s28	5.3	3.4	3	straight

Period	Sample	L	B	H	straight/twisted
KH-P VI	KIN18C3410s44	4.8	3	2.4	twisted
KH-P VI	KIN18C3410s44	5.8	3.5	2.4	nr
KH-P VI	KIN18C3410s44	5.3	2.5	2	nr
KH-P VI	KIN18C3410s44	6	3.2	2.4	twisted
KH-P VI	KIN18C3411s49	5.4	2.6	2.1	twisted
KH-P VI	KIN18C3411s49	6	3.2	2.2	twisted

L = length
B = breadth
H = height

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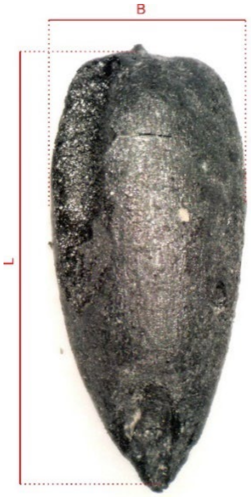
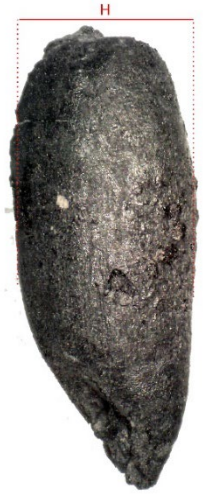
Period	Sample	L	B	H
KH-P I	KIN13B617s26	6.2	3	3
KH-P I	KIN13B617s26	4.5	2	1.8
KH-P I	KIN13B633s45	5.4	2	2
KH-P I	KIN13B633s45	4	2	1.8
KH-P I	KIN13B633s45	4.2	2.8	1.5
KH-P I	KIN13B633s45	3.7	1.5	15
KH-P I	KIN14B856s3	3.9	2	2.2
KH-P I	KIN13B638s60	5	2.2	2
KH-P I	KIN13B644s67	6	2.5	2.5
KH-P I	KIN12B522s96	5	2.5	2.2
KH-P I	KIN12B522s96	4.4	1.8	1.6
KH-P I	KIN12B522s96	5	2.4	2.2
KH-P II	KIN17A1830s12	5	2	2
KH-P II	KIN14B2031s133	5.5	2.8	2.4
KH-P II	KIN14B2031s133	4.3	2.2	2
KH-P II	KIN14B2031s133	5	2.1	2.1
KH-P II	KIN14B2031s133	5.9	2.8	2.1
KH-P II	KIN14B2031s133	5.5	2.3	2.5
KH-P II	KIN14B2031s133	5.6	2.5	2.5
KH-P II	KIN14B2031s133	4.8	2.4	2.3
KH-P II	KIN14B2031s133	5.8	2.6	2.2
KH-P II	KIN14B2031s133	4.7	2	2
KH-P II	KIN14B2031s133	5	2.5	2.1
KH-P II	KIN14B2031s133	5.7	2.7	2.7
KH-P II	KIN14B2031s133	5.7	3.2	2.6
KH-P II	KIN14B2031s133	6	2.8	2.6
KH-P II	KIN14B2031s133	5.9	3.1	2.4
KH-P II	KIN14B2031s133	5.4	2.4	2.1
KH-P II	KIN14B2031s133	5.8	2.8	2.4
KH-P II	KIN14B2031s133	5	2.4	2.5
KH-P II	KIN14B2031s133	4.5	2.1	2
KH-P II	KIN14B2031s133	3.8	2.2	2
KH-P II	KIN14B2031s133	5.2	2.2	2.3
KH-P II	KIN14B2031s133	5	2.5	2.4
KH-P III	KIN16A1711s67	5.5	2	2
KH-P III	KIN14B807s125	4.2	1.9	2
KH-P III	KIN15D2379s117	4	2.5	2.4

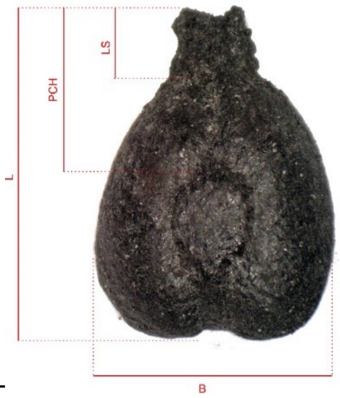
L = length
B = breadth
H = height





***Vitis vinifera* seeds**

Period	Sample	L	B	PCH	LS	T	notes
KH-P I	KIN12B522s96	4.3	3.2	2.6	0.9	2.6	
KH-P I	KIN12B540s130	4.2	2.7	2.6	1.3	2.2	
KH-P I	KIN13B644s67	6	3.8	3.5	1.4	2.8	
KH-P I	KIN13B644s67	4.2	2.5	2.4	1.4	2.2	
KH-P I	KIN13B644s67	5	3.4	3	1.4	2.7	
KH-P I	KIN13B762s122	5.2	3.2	2.6	1.2	3	
KH-P I	KIN14B855s4	4.8	3.4	2.3	1	2.9	
KH-P I	KIN14B855s4	4.3	3.1	2.5	1.2	2	
KH-P I	KIN14B865s17	4.4	2.8	2.9	1.2	2.2	
KH-P I	KIN14B895s78	3.6	3	1.8	1.2	1.7	
KH-P I	KIN15B2082s42	4.4	3.3	2.3	0.9	2.8	
KH-P I	KIN15B2082s42	4.2	3	2	0.9	2.3	
KH-P I	KIN16B2169s11	4.9	3.8	2.3	1.1	2.8	
KH-P II	KIN12A233s273	2.7	2	1.4	0.5	1.4	
KH-P II	KIN12B549s138	5.7	3.2	2.5	1	2.5	
KH-P II	KIN13A146s61	4.9	3.3	2.7	1.1	2.5	
KH-P II	KIN13A146s61	4.6	2.8	2.5	1.4	2.4	
KH-P II	KIN13A146s61	4.8	3.1	2.5	1.1	2.4	
KH-P II	KIN13A146s61	4.3	2.6	1.9	0.6	1.7	
KH-P II	KIN13A146s61	4.2	3.5	2.2	1.3	2.4	
KH-P II	KIN13A146s61	4.5	3.2	2.3	1	2.6	
KH-P II	KIN13A146s61	4	3.7	1.8	0.7	2.7	
KH-P II	KIN13A146s61	4.8	3.2	2.7	1	2.5	
KH-P II	KIN13A146s61	4.8	3.3	2.8	1	1.7	
KH-P II	KIN13A146s61	4.1	3.3	2	0.8	2.5	
KH-P II	KIN13A146s61	3.8	3.3	2	1	2.5	
KH-P II	KIN13A146s61	5.1	3.3	2.8	1.1	2.8	
KH-P II	KIN13A146s61	5.2	3.4	2.7	1.4	2.3	
KH-P II	KIN13A146s61	4.9	3.4	2.7	1.3	2.3	
KH-P II	KIN13A146s61	4.4	3.3	2.5	1	2.6	
KH-P II	KIN13A146s61	4.3	2.6	2.4	1.1	1.9	
KH-P II	KIN13A146s61	4.9	3.5	2.7	1.3	2.9	
KH-P II	KIN13A146s61	4.7	3.6	2.5	0.9	2.2	
KH-P II	KIN13A146s61	4.2	2.4	2.3	1.2	2	
KH-P II	KIN13A146s61	4.8	3.5	2.4	0.9	2.4	
KH-P II	KIN13A146s61	4.8	3.5	2.3	0.9	2.8	
KH-P II	KIN13A146s61	4.4	3.3	2.2	0.7	2.5	
KH-P II	KIN13A146s61	3.7	3	2	0.9	1.8	
KH-P II	KIN13A146s61	4.5	3.3	2.3	1	2	
KH-P II	KIN13A146s61	4	3.2	2	0.7	2.5	
KH-P II	KIN13A146s61	4.5	2.9	2.5	1.4	2.4	
KH-P II	KIN13A146s61	4.2	3.2	2.4	1.1	2	
KH-P II	KIN13A146s61	4.2	3.2	2.2	0.9	2.4	
KH-P II	KIN13A146s61	4.8	3.2	3	1.3	2.9	
KH-P II	KIN13A146s61	4.9	3.6	2.6	1	2.3	
KH-P II	KIN13A146s61	4.5	3.5	2.4	0.9	2.6	
KH-P II	KIN13A146s61	3.9	2.2	2.6	1.4	1.3	
KH-P II	KIN13A146s61	3.7	2.9	1.8	0.5	1.7	
KH-P II	KIN13A146s61	3.9	3.3	2	0.9	2.5	
KH-P II	KIN13A146s61	4.4	3	2	0.5	2.8	



Period	**Sample**	**L**	**B**	**PCH**	**LS**	**T**	**notes**
KH-P II	KIN13A146s61	4.8	3.4	2.3	1	2.3	
KH-P II	KIN13A146s61	4.9	3	1.8	0.7	2.4	
KH-P II	KIN13A146s61	4.4	3.6	2.4	0.9	3	
KH-P II	KIN13A146s61	4.6	3.9	2.5	1.2	2.9	
KH-P II	KIN13A146s61	4.6	3.4	2.5	1.2	2.1	
KH-P II	KIN13A146s61	5.3	3.2	2.5	1.5	2.3	
KH-P II	KIN13A146s61	3.7	3.2	1.9	0.9	2.2	
KH-P II	KIN13A146s61	4.5	3.4	2.2	1	2.8	
KH-P II	KIN13A146s61	4.7	3.2	3.2	1.2	2.5	
KH-P II	KIN13A146s61	3.4	2.8	1.4	0.4	2	
KH-P II	KIN13A146s61	5.1	3.3	2.2	0.9	2.8	
KH-P II	KIN13A146s61	5.1	3.5	2	1.3	2.8	
KH-P II	KIN13A146s61	4.9	3.5	2.6	1.1	2.3	
KH-P II	KIN13A146s61	3.8	3	2	0.6	2.3	
KH-P II	KIN13A146s61	5.2	3.2	3.2	1.5	2.3	
KH-P II	KIN13A146s61	4.2	3	2.3	1	2.3	
KH-P II	KIN13A146s61	4.4	3.1	2.2	0.8	2.3	
KH-P II	KIN13A146s61	4	3	2.2	1.4	2	
KH-P II	KIN13A146s61	3.9	2.8	2.2	0.7	1.8	
KH-P II	KIN13A146s61	4.4	3.5	2.2	0.8	1.7	
KH-P II	KIN13A146s61	4.9	3.3	2.8	1.3	2.3	
KH-P II	KIN13A146s61	4.9	3	2.6	1	nr	
KH-P II	KIN13A146s61	5.1	3.4	2.7	1.2	2.5	
KH-P II	KIN13A146s61	4.8	3.2	2.6	1.2	2.4	
KH-P II	KIN13A146s61	4.2	3.2	2.2	1	2.6	
KH-P II	KIN13A146s61	5.6	3.5	2.6	1.2	2.4	
KH-P II	KIN13A146s61	4.6	3.3	2.2	0.9	2.6	
KH-P II	KIN13A146s61	3.6	2.3	2	0.7	1.8	
KH-P II	KIN13A146s61	5.1	3.5	2.7	1	2.7	
KH-P II	KIN13A146s61	4	3.3	1.9	0.9	2.5	
KH-P II	KIN13A146s61	5.6	3.5	2.4	1.5	3	
KH-P II	KIN13A146s61	4.5	3	2.5	1.1	2.2	
KH-P II	KIN13A146s61	3.9	2.5	2.1	1	2.2	
KH-P II	KIN13A146s61	4	2.7	2.2	1	2.2	
KH-P II	KIN13A146s61	4.3	3.3	2.2	0.7	3	
KH-P II	KIN13A146s61	4.2	3.5	2.2	0.5	2.5	
KH-P II	KIN13A146s61	4.4	3.2	2.5	1.2	2.5	
KH-P II	KIN13A146s61	5.1	3.3	2.7	1	2.2	
KH-P II	KIN13A950s242	5.2	3.4	2.9	1	nr	
KH-P II	KIN13A967s266	3.5	1.8	2.2	1.1	0.8	undeveloped
KH-P II	KIN13A967s266	4.7	3.3	2.3	0.9	2.3	
KH-P II	KIN13A967s266	5	3.5	2.6	1.2	2.3	
KH-P II	KIN13A967s266	4.3	3.4	2.3	0.9	2.5	
KH-P II	KIN13A967s266	4.7	3.4	2.4	1.1	2.4	
KH-P II	KIN13A967s266	4.9	3.5	2.4	1	2.8	
KH-P II	KIN13A967s266	4.4	3.2	2.5	0.9	2.5	
KH-P II	KIN13A967s266	5.2	3.7	2.6	1.1	2.5	
KH-P II	KIN13A967s266	4.5	3.5	2.8	0.7	2.3	
KH-P II	KIN13A967s266	4.8	3.1	2.7	1	2.7	
KH-P II	KIN13A967s266	4.9	4.1	2.7	1.1	3	
KH-P II	KIN13A967s266	4.9	3.8	2.5	1	3.1	

Period	Sample	L	B	PCH	LS	T	notes
KH-P II	KIN13A967s266	4.3	3.8	2.4	1	2.9	
KH-P II	KIN13A967s266	5.2	4.2	2.9	1	3	
KH-P II	KIN13A967s266	4.5	3.7	2.5	1	2.9	
KH-P II	KIN13A967s266	5.2	3.7	3	1.3	2.7	
KH-P II	KIN13A967s266	5.2	4.1	2.5	1.1	3.2	
KH-P II	KIN13A967s266	4.8	3.7	2.6	1	3	
KH-P II	KIN13A967s266	5	3.7	2.5	1	2.3	
KH-P II	KIN13A967s266	5	3.7	2.7	1.1	2.3	
KH-P II	KIN13A967s266	4.8	3.6	2.4	0.9	2.7	
KH-P II	KIN13A967s266	4.5	3.7	3.1	0.7	3.3	
KH-P II	KIN13A967s266	5.2	4	2.8	1.2	2.8	
KH-P II	KIN13A967s266	4.2	3.8	1.9	0.4	2.4	
KH-P II	KIN13A967s266	5.4	3.1	2.2	1.3	2.7	
KH-P II	KIN13D1641s23	4.3	2.4	2.5	1	1.7	
KH-P II	KIN13D1641s23	4.5	3.2	2.2	1.1	2.4	
KH-P II	KIN14A1502s44	4.7	3.4	2.5	0.8	2.5	
KH-P II	KIN14A1512s48	4.8	3	2.9	1.1	2.4	
KH-P II	KIN14A1512s48	4.8	3.3	2.5	0.8	nr	
KH-P II	KIN14A1512s48	4.4	3	2.1	0.8	2.7	
KH-P II	KIN14A1512s48	6	3.3	3.5	1.7	2.4	
KH-P II	KIN14A1512s48	4.6	3.8	2.4	0.8	2.4	
KH-P II	KIN14A1512s48	4.9	3.5	2.5	1	2.4	
KH-P II	KIN14A1512s48	4.4	3.4	2.4	1	2.1	
KH-P II	KIN14A1512s48	4.1	3.2	2	1	2.3	
KH-P II	KIN14A1512s48	5.1	3	2.7	1.3	2.3	
KH-P II	KIN14A1512s48	4	2.9	2.2	0.9	2	
KH-P II	KIN14A1512s48	5.5	3.2	3.4	1.5	2.3	
KH-P II	KIN14A1512s48	4	2.9	2.3	0.8	2.4	
KH-P II	KIN14A1512s48	4.8	3.8	2.5	1	2.5	
KH-P II	KIN14A1534s101	4.6	3.1	2.4	1.1	2	
KH-P II	KIN14A1534s101	4.8	3	2.3	1.2	2.5	
KH-P II	KIN14A1534s101	4	3.1	2.3	1.1	2.3	
KH-P II	KIN14A1534s101	3.6	2.7	1.7	0.5	2	
KH-P II	KIN14A1534s101	4.3	2.4	2.5	1	2.3	
KH-P II	KIN14A1534s101	3.4	1.7	2	1	1.1	undeveloped
KH-P II	KIN14A1534s101	2.6	1.3	1.8	1	1	undeveloped
KH-P II	KIN14B2031s133	4	3.1	2.1	0.6	2.3	
KH-P II	KIN14B2031s133	4	3.6	1.9	0.6	3.2	
KH-P II	KIN15A1539s77	4	2.5	2.3	1	2	
KH-P II	KIN15A1539s77	4.2	3	2.3	0.8	1.8	
KH-P II	KIN15A1539s77	3.6	2.4	2	1.1	1.6	
KH-P II	KIN15A1539s77	3.9	2.8	2	0.9	2.2	
KH-P II	KIN15A1539s77	3.9	2.9	2.1	1	2.2	
KH-P II	KIN15A1539s77	3.9	3	2.2	1	2.2	
KH-P II	KIN15A1539s77	4.1	3	2.1	0.9	2.1	
KH-P II	KIN15A1539s77	4.2	3.1	2.5	0.9	2.2	
KH-P II	KIN15A1539s77	2.9	2.2	1.9	0.9	1.3	
KH-P II	KIN15A1539s77	4.4	3.3	2.4	1.2	2	
KH-P II	KIN15A1539s77	4.5	2.7	2.7	1.4	2	
KH-P II	KIN15A1539s77	3.4	2.2	1.7	1	1.6	
KH-P II	KIN15A1539s77	5	3	2.7	1.2	2.5	

Period	Sample	L	B	PCH	LS	T	notes
KH-P II	KIN15A1539s77	3.3	2.3	2.8	0.8	1.9	
KH-P II	KIN15A1539s77	4.1	2.8	2.2	1	1.9	
KH-P II	KIN15A1539s77	3.7	2.5	2.2	1.2	1.9	
KH-P II	KIN15A1539s77	4	2.5	1.8	0.9	1.8	
KH-P II	KIN15A1539s77	4.4	3.3	2.5	1.2	2.5	
KH-P II	KIN15A1539s77	4.5	2.7	2.3	1.3	2.3	
KH-P II	KIN15A1539s77	4	2.6	2.2	1.1	1.6	
KH-P II	KIN15A1539s77	4.8	3.5	2.4	1	2.5	
KH-P II	KIN15A1539s77	3.5	3	1.7	0.7	2.2	
KH-P II	KIN15A1539s77	3.7	2.6	2	0.7	2	
KH-P II	KIN15A1539s77	3.3	2.3	1.8	0.9	1.7	
KH-P II	KIN15A1539s77	4.8	3.1	2.7	1	2.4	
KH-P II	KIN15A1539s77	3.9	3	2.3	0.9	2.2	
KH-P II	KIN15A1539s77	3.1	2.5	1.5	0.7	1.7	
KH-P II	KIN15A1539s77	4.1	2.8	2.2	1.1	2.1	
KH-P II	KIN15A1539s77	3.5	3	1.9	0.8	2.2	
KH-P II	KIN15A1539s77	3.3	2.3	2	1	1.6	
KH-P II	KIN15A1539s77	3.5	2.5	2	1.2	1.5	
KH-P II	KIN15A1539s77	3.4	2	2	0.9	1.3	
KH-P II	KIN15A1539s77	3.2	1.7	2	1.2	1	undeveloped
KH-P II	KIN15A1539s77	3.4	1.8	2.4	1.2	0.8	undeveloped
KH-P II	KIN15A1539s77	3.8	2	2.5	1.4	1.3	
KH-P II	KIN15A1539s77	2.6	1.5	1.5	0.8	0.7	undeveloped
KH-P II	KIN15A1539s77	2.7	1.8	1.6	0.9	1.1	undeveloped
KH-P II	KIN15A1539s77	3	1.6	2	1.3	0.9	undeveloped
KH-P II	KIN15A1539s77	2.5	1.3	1.7	1.1	0.9	undeveloped
KH-P II	KIN15A1539s77	1.5	0.8	0.7	1	0.6	undeveloped
KH-P II	KIN15A1539s77	nr	nr	nr	nr	n	undeveloped
KH-P II	KIN16B2181s34	3.6	1.7	2.4	1.3	1.4	
KH-P II	KIN17A1830s12	4.3	2.4	2.5	1.2	2.2	
KH-P II	KIN17A1830s12	5.2	3.2	2.7	1.5	2.6	
KH-P II	KIN18A1987s73	4.2	3	2.3	0.9	2	
KH-P II	KIN13B767s126	3.6	3	2	0.7	2.3	
KH-P II	KIN15B2109s93	4.6	3	2.4	1	2.5	
KH-P II	KIN15B2109s93	4.7	3.1	2.4	0.9	2.5	
KH-P II	KIN15B2109s93	4.9	3.4	2.8	1.3	2.3	
KH-P II	KIN15B2109s93	4.8	2.8	2.5	1.1	2.4	
KH-P II	KIN15B2109s93	4.9	3.4	2.5	0.9	2.5	
KH-P II	KIN15B2109s93	4.3	2.9	2.5	1.2	2.3	
KH-P II	KIN15B2109s93	4.4	3	2	0.9	2.3	
KH-P II	KIN15B2109s93	3.9	2.6	2.2	1.1	2	
KH-P II	KIN15B2109s93	5.6	3.4	2.9	0.9	2.5	
KH-P II	KIN15B2109s93	5.6	3.2	3.4	1.3	2.3	
KH-P II	KIN15B2109s93	5.1	3.4	3	1.4	2.7	
KH-P II	KIN15B2109s93	5.1	3.6	2.2	1.2	2.3	
KH-P II	KIN15B2109s93	5	3.5	2.9	1	2.4	
KH-P II	KIN15B2109s93	4.5	3.2	2.4	1	2.4	
KH-P II	KIN15B2109s93	4.9	3.6	2.5	1	3	
KH-P II	KIN15B2109s93	4.5	3	2.7	1.4	2.3	
KH-P II	KIN15B2109s93	3.8	2.9	2.2	0.6	2.4	
KH-P II	KIN15B2109s93	4.3	3.6	2	0.9	2.3	

Period	Sample	L	B	PCH	LS	T	notes
KH-P II	KIN15B2109s93	5.5	3.7	3	1.5	2.7	
KH-P II	KIN15B2109s93	4.5	2.5	2.5	1.1	1.9	
KH-P II	KIN15B2109s93	4.3	3.5	2.3	0.9	2.6	
KH-P II	KIN15B2109s93	5.2	3.9	2.8	1.2	2.7	
KH-P II	KIN15B2109s93	4.2	3.3	2.3	0.7	2.4	
KH-P II	KIN15B2109s93	4.5	3.5	2.5	1	2.3	
KH-P II	KIN15B2109s93	5.3	3.6	3	1.4	2.3	
KH-P II	KIN15B2109s93	4.1	2.3	2.4	0.9	2.5	
KH-P II	KIN15B2109s93	5.7	3.4	3	1	2.6	
KH-P II	KIN15B2109s93	4.5	3.5	2.5	0.9	2.4	
KH-P II	KIN15B2109s93	5.4	3.3	3	1.3	2.4	
KH-P II	KIN15B2109s93	2.9	2.7	1.3	0.3	2.4	
KH-P II	KIN15B2109s93	4.8	3.8	2.7	1	2.7	
KH-P II	KIN15B2109s93	4.8	3.1	2.5	1	2.5	
KH-P II	KIN15B2109s93	4.6	3.2	2.6	1	2.5	
KH-P II	KIN15B2113s108	5.2	3.2	3	1.1	2.3	
KH-P II	KIN16B2221a116	4.5	2.9	2.4	1.2	2.3	
KH-P III	KIN13A175s117	3.7	2.8	nr	0.7	nr	
KH-P III	KIN13A175s117	3.5	2.7	2	0.9	1.5	
KH-P III	KIN13A175s117	3.6	2.2	2	1	1.7	
KH-P III	KIN13A175s117	4.5	3	2.5	1	2.4	
KH-P III	KIN13A175s117	4.2	2.9	2.1	1	1.6	
KH-P III	KIN13A175s117	4	3	2.2	0.9	2.3	
KH-P III	KIN13A175s117	4.5	4	2.5	0.9	1.8	
KH-P III	KIN13A175s117	3.8	2.6	2	0.8	1.7	
KH-P III	KIN13A175s117	5	3.6	3.3	1.5	2.3	
KH-P III	KIN13A175s117	4.3	3.3	2.2	1	2.2	
KH-P III	KIN13A175s117	3.8	2.7	1.8	0.7	1.7	
KH-P III	KIN13A175s117	5	3.3	2.9	1	2.5	
KH-P III	KIN13A175s117	4.5	3	2.5	1.2	2.5	
KH-P III	KIN13A175s117	4.9	3.5	2.3	0.9	2.8	
KH-P III	KIN13A175s117	5	3.5	nr	nr	2.8	
KH-P III	KIN13A175s117	4.1	3.5	2.3	0.8	2.1	
KH-P III	KIN13B802s162	4.9	3.6	1.9	0.7	nr	
KH-P III	KIN13B807s175	4.6	4.4	2.3	0.8	3.3	
KH-P III	KIN13B807s175	4	3.2	1.7	0.7	1.8	
KH-P III	KIN13B807s175	4	4.2	2	0.7	3.1	
KH-P III	KIN13B807s175	6.1	4.1	3.5	1.2	2.9	
KH-P III	KIN13B807s175	5	3.3	2.7	0.8	2.6	
KH-P III	KIN13B807s175	5.6	3.3	3	1.4	2.4	
KH-P III	KIN13B807s175	5.8	4	3	0.9	3.2	
KH-P III	KIN13B807s175	5.9	3.5	3	1	2.8	
KH-P III	KIN13B807s175	4.4	3	2.3	1	2.6	
KH-P III	KIN13B807s175	5.1	3.6	2.8	1	3.2	
KH-P III	KIN13B807s175	5.2	4	2.9	1.2	3	
KH-P III	KIN13B807s175	4.9	3.9	2.5	1	2.8	
KH-P III	KIN13B807s175	5.2	4.1	2.5	0.9	3.4	
KH-P III	KIN13B807s175	4.8	3.5	2.5	0.7	2.2	
KH-P III	KIN13B807s175	4.6	3.5	2.4	0.8	3	
KH-P III	KIN13B807s175	5.5	4.2	2	1	3.3	
KH-P III	KIN13B807s175	5.7	3.6	2.7	1	3.3	

Period	Sample	L	B	PCH	LS	T	notes
KH-P III	KIN13B807s175	5.5	3.4	3	1.2	2.8	
KH-P III	KIN13B807s175	4.7	3.7	2.9	0.8	2.8	
KH-P III	KIN13B807s175	4.2	2.8	2.2	1.1	2.5	
KH-P III	KIN13B807s175	5.7	3.8	2.7	0.8	3	
KH-P III	KIN13B807s175	4.5	3.7	2	0.5	2.8	
KH-P III	KIN13B807s175	3.5	2.4	2	0.9	1.8	
KH-P III	KIN13B807s175	3.2	1.5	1.9	1.2	0.6	undeveloped
KH-P III	KIN13D1144s185	5.5	3.8	2.5	1.2	3.3	
KH-P III	KIN13D1144s185	5.3	3.6	2.1	1	3	
KH-P III	KIN13D1144s185	4.2	3.2	2.5	1	2.2	
KH-P III	KIN13D1144s185	4.5	3.4	2.6	1	2.8	
KH-P III	KIN13D1144s185	4.9	3.5	2.5	0.9	3.2	
KH-P III	KIN13D1144s185	5.1	3.5	2.6	1	2.9	
KH-P III	KIN13D1144s185	5.5	3.6	3.2	1.4	3.3	
KH-P III	KIN13D1144s185	7	4.9	nr	1.4	nr	
KH-P III	KIN13D1144s185	5.7	3.7	2.7	1.4	2.8	
KH-P III	KIN13D1144s185	5.3	3.2	3.2	1.2	2.5	
KH-P III	KIN13D1144s185	4.9	3.9	2.3	1.1	3	
KH-P III	KIN13D1144s185	5.2	3.3	1.9	1.6	2.8	
KH-P III	KIN13D1144s185	4.8	3.7	2.7	1.1	3	
KH-P III	KIN13D1144s185	5	4.3	2.7	1	3.3	
KH-P III	KIN13D1144s185	6.3	3.9	3.5	1.9	3	
KH-P III	KIN13D1144s185	5.2	3.2	nr	1.2	2.7	
KH-P III	KIN13D1144s185	5.2	3.6	3	1	3	
KH-P III	KIN13D1144s185	4.4	3	2.3	0.9	2.7	
KH-P III	KIN13D1144s185	4.8	3	nr	1	2.4	
KH-P III	KIN13D1144s185	5.6	3.8	3.2	1	2.5	
KH-P III	KIN13D1144s185	5.5	3.8	nr	1.5	nr	
KH-P III	KIN13D1144s185	5	3.9	2.9	1.2	3.1	
KH-P III	KIN13D1144s185	4	3.3	2.1	1	2.7	
KH-P III	KIN13D1144s185	4.8	3.8	2.5	1.1	2.5	
KH-P III	KIN13D1144s185	4.8	4.2	2.4	1	3.3	
KH-P III	KIN13D1144s185	4.8	3.9	2	0.9	3.4	
KH-P III	KIN13D1144s185	5.5	3.7	2.7	1.1	3.2	
KH-P III	KIN13D1144s185	5.3	3.2	2.3	1.1	2.6	
KH-P III	KIN13D1144s185	5.3	3.5	nr	1.5	2.7	
KH-P III	KIN13D1144s185	4.8	3.3	2.9	1.3	2.8	
KH-P III	KIN13D1144s185	4.2	2.1	2.8	1.8	1.4	undeveloped
KH-P III	KIN13D1144s185	4.1	2.2	2.7	1.7	1.8	undeveloped
KH-P III	KIN13D1144s185	3.9	2.1	2.5	1.3	1.5	undeveloped
KH-P III	KIN13D1144s185	3.2	2.3	1.9	0.8	1.3	undeveloped
KH-P III	KIN13D1144s185	3.4	2	nr	1.3	1.3	undeveloped
KH-P III	KIN13D1144s185	3.5	2	2.4	1.3	1.3	undeveloped
KH-P III	KIN13D1144s185	2.8	1.5	nr	1	1.1	undeveloped
KH-P III	KIN13D1144s185	2.1	1.1	nr	nr	0.9	undeveloped
KH-P III	KIN14B2002s105	5.2	3.5	3	1.3	2.4	
KH-P III	KIN14B2002s105	5.6	3.8	2.7	0.8	3.1	
KH-P III	KIN14B2002s106a	4.4	3.1	2.5	1	2.1	
KH-P III	KIN14B2002s106a	4.8	3.6	3.1	0.9	2.7	
KH-P III	KIN14B2002s106a	5.1	3.1	2.2	1.2	2.4	
KH-P III	KIN14B2002s106a	4	3.2	2	0.7	2.2	

Period	Sample	L	B	PCH	LS	T	notes
KH-P III	KIN14B2002s106a	4.2	3.3	2.4	0.5	2.5	
KH-P III	KIN14B2002s106b	3.8	2.8	2	0.7	2.1	
KH-P III	KIN14B2002s106b	4	2.2	2.3	1	1.7	
KH-P III	KIN14B807s38b	4.5	3	nr	nr	nr	
KH-P III	KIN14B876s115	4.7	3	2.5	1	nr	
KH-P III	KIN14B899s91	5	3.5	2.7	1	2.6	
KH-P III	KIN14B899s91	4.8	3	2.5	1	2.6	
KH-P III	KIN14B899s91	4	3	2.4	0.5	2.3	
KH-P III	KIN14D1126s4	5.2	3.6	2.2	0.9	3.2	
KH-P III	KIN14D1126s4	4.4	3.1	2.4	0.8	2.3	
KH-P III	KIN14D1126s4	5.9	3.4	2.4	0.7	2.5	
KH-P III	KIN14D1126s4	5.1	3.4	2.9	1	2.7	
KH-P III	KIN14D1126s4	5.6	3.9	2.9	1.2	2.8	
KH-P III	KIN14D1126s4	3.5	2.5	2	1	1.9	
KH-P III	KIN14D1126s4	5	3.6	3	1	2.5	
KH-P III	KIN14D1126s4	4.2	2.6	2.5	1.2	2.1	
KH-P III	KIN14D1126s4	4.5	3.3	2.5	1	2.2	
KH-P III	KIN14D1126s4	4.5	3.4	2.7	1.1	3	
KH-P III	KIN14D1126s4	4.4	3.3	2.8	0.8	2.4	
KH-P III	KIN14D1126s4	4.7	3.5	2.8	1.1	2.6	
KH-P III	KIN14D1149s73	6.1	3.4	2.9	1.4	2.5	
KH-P III	KIN14D1155s20	4	2.8	2.1	1.2	1.5	
KH-P III	KIN14D1155s20	4	3.3	2	1	2.1	
KH-P III	KIN14D1155s20	4.5	3.4	2	0.8	2.5	
KH-P III	KIN14D1168s52	4.7	3.3	2.1	1.1	2.5	
KH-P III	KIN14D2314s140	4.9	3.1	2.2	0.9	2.5	
KH-P III	KIN14D2385s150	4.9	2.8	2.7	1.8	2.3	
KH-P III	KIN14D2385s150	3.8	2.4	2	0.9	1.8	
KH-P III	KIN15A1685s131	3.7	2.4	1.9	0.9	2	
KH-P III	KIN15A1685s131	4.1	2.8	2.4	1.2	2	
KH-P III	KIN15A1685s131	4	3.1	2.2	0.8	2.4	
KH-P III	KIN15A1685s131	4.3	2.9	2.2	0.7	2.3	
KH-P III	KIN15A1685s131	4.4	3.4	2.1	0.8	3	
KH-P III	KIN15A1685s131	4.2	2.9	2.4	1	1.9	
KH-P III	KIN15A1685s131	3.7	2.8	2.1	0.6	1.6	
KH-P III	KIN15A1685s131	4.1	3	2.2	0.9	2.2	
KH-P III	KIN15A1685s131	4.1	2.3	2.2	1	2	
KH-P III	KIN15A1685s131	4.2	2.9	2.3	0.8	2	
KH-P III	KIN15A1685s131	5.1	3.3	2.7	1.2	2.7	
KH-P III	KIN15A1685s131	4.4	2.9	2.3	1.1	2	
KH-P III	KIN15A1685s131	4.6	3.3	2	0.8	2.1	
KH-P III	KIN15A1685s131	3.9	3.1	2	0.8	2.6	
KH-P III	KIN15A1685s131	4.7	3	2.7	1	2.4	
KH-P III	KIN15A1685s131	3.9	2.5	2	1.1	1.9	
KH-P III	KIN15A1685s131	4.3	3.2	2.4	0.9	2.2	
KH-P III	KIN15A1685s131	3.6	2.9	1.9	0.8	2.1	
KH-P III	KIN15A1685s131	4	3	2.3	0.7	2.1	
KH-P III	KIN15A1685s131	4.5	2.9	2.3	0.5	2.5	
KH-P III	KIN15A1685s131	3.9	2.6	2	0.8	2	
KH-P III	KIN15A1685s131	3.9	2.8	1.9	0.7	2.3	
KH-P III	KIN16A1683s4	5.2	2.9	3	1.3	2.3	

Period	Sample	L	B	PCH	LS	T	notes
KH-P III	KIN16A1685s52	4.8	3.3	2.8	0.9	2.1	
KH-P III	KIN16A1685s52	4.7	3.2	2.6	1	2.1	
KH-P III	KIN16A1685s52	3.9	3.1	2.3	0.8	2.2	
KH-P III	KIN16A1685s52	4.3	3.3	2.4	0.9	2.5	
KH-P III	KIN16A1685s52	4.6	3.5	nr	nr	2.1	
KH-P III	KIN16A1685s52	4.5	3.8	nr	nr	2.6	
KH-P III	KIN16A1685s52	4.4	3.5	2.5	0.9	3.1	
KH-P III	KIN16A1685s52	4.6	3.2	nr	nr	2.5	
KH-P III	KIN16A1685s52	3.5	2.6	1.8	0.6	1.5	
KH-P III	KIN16A1685s52	4	3.2	2.4	0.7	2.7	
KH-P III	KIN16A1685s52	3.4	2.6	1.5	0.6	1.9	
KH-P III	KIN16A1685s52	3.7	2.6	1.9	0.9	2.2	
KH-P III	KIN16A1721s55	4.5	3.2	2.8	1.3	2.6	
KH-P III	KIN16A1721s55	3.9	3.1	2.1	0.9	1.9	
KH-P III	KIN16A1721s55	4.4	2.8	2.5	1	2.3	
KH-P III	KIN16A1721s55	4.2	3	2.3	0.8	2.1	
KH-P III	KIN16A1721s55	3.1	2.2	1.5	0.4	1.7	
KH-P III	KIN16A1721s55	4.4	3	2.5	1	2.3	
KH-P III	KIN16A1721s55	4.7	3.2	2.5	1.2	2.4	
KH-P III	KIN16A1721s55	3.5	2.7	1.6	0.7	2	
KH-P III	KIN16A1745s93	3.7	2.6	1.9	0.8	1.9	
KH-P III	KIN16A1745s93	5.5	3.6	3.1	1.1	2.9	
KH-P III	KIN16A1745s93	4.9	3.5	2.6	1.1	2.8	
KH-P III	KIN16A2689s26	4.1	2.9	2.3	1	2.2	
KH-P III	KIN16A2689s26	4	2.5	2	0.8	nr	
KH-P III	KIN16A2689s26	4.4	3.4	2.3	1	2.3	
KH-P III	KIN16A2689s26	4.2	3	2.1	1	2.4	
KH-P III	KIN16A2689s26	4.4	3.2	2.2	1	2.6	
KH-P III	KIN16A2689s26	4.5	3.1	2.5	1	2.2	
KH-P III	KIN16A2689s26	4	3.2	2.5	0.5	2	
KH-P III	KIN16D2416s37	4.3	2	2.4	1.1	1.5	
KH-P III	KIN17A1771s65	4.4	4	nr	nr	3	
KH-P III	KIN17A1771s65	4.8	3.6	2.5	0.7	nr	
KH-P III	KIN17A1893s149	4.2	3.2	2.4	0.8	2.2	
KH-P III	KIN17A1893s149	4.4	2.8	2.5	0.8	2	
KH-P III	KIN17A1893s149	5	3.3	2.9	1.2	2.5	
KH-P III	KIN17A1893s149	4.8	3.2	2.7	1.2	2.3	
KH-P III	KIN17A1893s149	4.9	3.8	2.8	1	2.8	
KH-P III	KIN17A1893s149	4.4	3.8	2.6	0.8	2.8	
KH-P III	KIN17A1893s149	5	3.5	2.8	1.1	2.6	
KH-P III	KIN17A1894s157	4.5	3.6	2.5	0.8	2.2	
KH-P III	KIN17A1894s157	4.8	3.3	2.7	0.9	2.5	
KH-P III	KIN17A1894s157	5.2	3.8	3.1	1.2	2.5	
KH-P III	KIN17A1894s157	4	3.1	2	0.5	1.8	
KH-P III	KIN17A1894s157	4.8	3.4	2.8	1	2.3	
KH-P III	KIN17A1894s157	4.7	3.4	2.5	1	2.7	
KH-P III	KIN17A1894s157	4.7	3.5	2.5	1	2.9	
KH-P III	KIN17A1894s157	5	3.8	2.8	1	2.3	
KH-P III	KIN17A1894s158	4.2	3.2	1.8	0.5	nr	
KH-P III	KIN17A1894s158	5	3.7	2.1	0.7	nr	
KH-P III	KIN18A1996s91	4.8	3.5	2.8	1	2.1	

Period	Sample	L	B	PCH	LS	T	notes
KH-P III	KIN18A1996s91	4.1	3	2.3	1	1.8	
KH-P III	KIN18A1996s91	3.8	3.1	2	0.6	2.3	
KH-P III	KIN18A1996s91	4.6	3.7	2.1	0.8	2.6	
KH-P III	KIN18A1996s91	4.6	4	2.7	1.1	3	
KH-P III	KIN18A1996s91	3.8	2.3	2.6	1.1	1.1	undeveloped
KH-P III	KIN18A1996s91	4.5	2.8	2.2	0.6	2.2	
KH-P III	KIN18A1996s91	4.4	3	2.2	0.8	2.1	
KH-P IV	KIN12A250s267	4.7	3.4	2.5	1	2.5	
KH-P IV	KIN12A250s267	4.1	3	2	0.9	2.2	
KH-P IV	KIN12A250s267	4.6	3.2	2.5	1.2	2.3	
KH-P IV	KIN12A250s267	4.4	3	2.2	0.7	2.2	
KH-P IV	KIN12A250s267	4.5	3.5	2.1	0.8	2.9	
KH-P IV	KIN12A250s267	4.1	2.3	2.3	1.2	1.5	
KH-P IV	KIN12A250s267	4.2	3.4	2.3	0.5	2.5	
KH-P IV	KIN12A250s267	4.5	2.9	2.4	1	2	
KH-P IV	KIN12A291s313	4.6	3.3	2.4	1.2	2.7	
KH-P IV	KIN12A291s313	4.8	3.2	2.4	1	2.3	
KH-P IV	KIN12A291s313	5	4	2.9	1.3	2.8	
KH-P IV	KIN12A291s313	5	4	3	1.2	2.9	
KH-P IV	KIN12A291s313	4.9	3.3	2	1	2.6	
KH-P IV	KIN12A291s313	4.9	3.7	2.5	1.1	2.8	
KH-P IV	KIN12A291s313	4.9	3	2.5	1.1	3	
KH-P IV	KIN12A291s313	4.4	2.3	2.3	1.4	1.9	
KH-P IV	KIN12A291s313	5	3.5	2.5	0.7	2.2	
KH-P IV	KIN15C2520s11	4.5	3.3	3.3	0.9	2.2	
KH-P IV	KIN17C2683s13	3.6	2	2	1.3	1.5	
KH-P IV	KIN17C2812s22	4.5	3	2.5	1	2	
KH-P IV	KIN17C2812s39	5.3	3.8	3	1.1	2.7	
KH-P IV	KIN17C2812s39	4.5	3.2	2.2	0.9	2.1	
KH-P IV	KIN17C2814s27	5.2	3.8	2.5	1	3.4	
KH-P IV	KIN17C2814s27	4	2.7	1.9	0.7	2.2	
KH-P IV	KIN17C2834s51	5	3	2.7	1.5	2.5	
KH-P IV	KIN17C2834s51	4.8	3.1	1.9	0.8	2.3	
KH-P IV	KIN18A1377s3	4.7	4	2.6	1	3.4	
KH-P IV	KIN18A1377s3	4.8	3.2	2.7	1.3	2.8	
KH-P IV	KIN18A1379s31	4.4	3.5	2.4	1.1	2.8	
KH-P IV	KIN18A1379s31	4.9	3.2	2.4	1.2	2.4	
KH-P IV	KIN18A1379s31	4.2	3.5	2.2	0.8	3	
KH-P IV	KIN18A1397s36	4.7	3.4	2.3	0.9	2.8	
KH-P IV	KIN18A1397s36	3.7	3.1	2.4	0.8	2	
KH-P IV	KIN18C2870s13	5.6	4	3	1.4	2.8	
KH-P IV	KIN18C2870s13	4.7	3.1	2.8	1.2	2.5	
KH-P IV	KIN18C2870s13	4.5	3.8	2.3	0.7	2.7	
KH-P IV	KIN18C2870s13	3.2	2.1	2.1	0.8	1.7	
KH-P IV	KIN18C2870s15	5	3.9	2.7	1	2.3	
KH-P IV	KIN18C2870s15	5.4	3.5	3	1.3	2.9	
KH-P IV	KIN18C2870s15	4.9	3.5	3	1.1	3.8	
KH-P IV	KIN18C2870s15	4.2	2.9	2.1	0.9	2.5	
KH-P IV	KIN18C2870s15	nr	nr	nr	nr	nr	undeveloped
KH-P VA	KIN17A1406s17	4.6	3.2	2.2	1.1	2.7	
KH-P VA	KIN17A1406s17	5.3	3.3	3.7	1.1	2.9	

Period	Sample	L	B	PCH	LS	T	notes
KH-P VA	KIN17A164s55	4	2.3	2.5	1	1.7	
KH-P VA	KIN17A164s55	4.6	3.5	2.1	0.8	2.9	

L = length

B = breadth

PCH = distance from the base of chalaza to the tip of the stalk

LS = length of stalk

T = thickness

BIBLIOGRAPHY

Abe, T. (2012). Dascylium: An Overview of the Achaemenid Satrapal City. *The Kyoto Journal of Ancient History* 12, 1-17.

Adams, R. M. (1981). *Heartland of cities: Surveys of ancient settlement and land use on the central floodplain of the Euphrates*. University of Chicago Press.

Adiego, I. X. (2021). Observacions sobre la nova inscripció lúvia jeroglifica del gran rei Hartapu (Türmen-Karahöyük I). In: L. F. Mateu, A. M. Albà, J. V. Palomino (eds), *"Sentido de un empeño": homenatge a Gregorio del Olmo Lete*, Universitat de Barcelona, 13-22.

Aitchison, J. E. T. (1891). Notes to assist in a further knowledge of the products of Western Afghanistan and of North-Eastern Persia. *Transactions of the Botanical Society of Edinburgh*, 18(1-4), 1-228.

Akbaş, P., Kaya, E., Alkan, H., and Ceylan, G. (2020). Determination of the content of Hyoscyamus reticulatus seeds by xrf method and antibacterial characteristics of ethyl alcohol extract. *Eskişehir Technical University Journal of Science and Technology Applied Sciences and Engineering*, 21(1), 199-204.

Akkaya, M. (1992). Objets phrygiens en bronze du tumulus de Kaynarca. In B. Le Guen-Pollet, and O. Pelon (eds), *Cappadoce meridionale jusqu'a la fin de l'epoque romaine etat des recherches*, ERC, 25-27.

Akkemik, Ü., (2004). Archaeobotanical and Dendroarchaeological Studies in Ilgarini Cave (Pinarbasi, Kastamonu, Turkey). *Turkish Journal of Agriculture and Forestry*, 28, 9–17.

Akkemik, Ü., (2015). *Woods of Yenikapı Shipwrecks*. Ege Yayinlari.

Akkemik, Ü., and Barbanos, Y. (2012). *Wood anatomy of Eastern Mediterranean species*. Verlag.

Akkemik, Ü., and Kocabaş, U. (2014). Woods from Byzantine trade ships of Tenikapi (Istanbul) and changes in wood use from 6th to 11th century. *Mediterranean Archaeology and Archaeometry* 14, 301–311.

Akkemik, Ü., and Metin, M. (2011). Ankara-Nallıhan-Çayırhan Juliopolis Nekropolü'nün Tabutlarında Kullanılan Ağaçların Cins / Tür Teşhisleri. *Journal of the Faculty of Forestry*, 61, 105–114

Akkemik, Ü., Zencirkaya, A., and Kayguszu, I. (2019). Identification and evaluation of the wood materials used in two historical djemevies in the village of Onar (Arapgir, Malatya). *Eurasian Journal of Forest Science*, 7, 40–53.

Akkermans, P. M., and Duistermaat, K. (1996). Of storage and nomads The sealings from late Neolithic Sabi Abyad, Syria. *Paléorient*, 22(2), 17-44.

Alcolea, M., Dufraisse, A., Royo, M., Mazo, C., de Luis, M., Longares, L. A., Utrilla, P. and Fábregas, R. (2021). Dendro-anthracological tools applied to Scots type pine forests exploitation as fuel during the Mesolithic-Neolithic transition in the southern central pre-Pyrenees (Spain). *Quaternary International*, 593/594, 332-345.

Algaze, G. (1993). *The Uruk world system: The dynamics of expansion of early Mesopotamian civilization*. University of Chicago Press.

Algaze, G. (2001). Initial Social Complexity in Southwestern Asia: The Mesopotamian Advantage. *Current Anthropology,* 42(2), 199-233

Algaze, G., Ataman, K., Ingraham, M., Marfoe, L., McDonald, M., Miller, N. F., Snow, C., Stein, G. Verharen, B., Wattenmaker, P., Wilkinson, T., and Yener, A. (1986). The Chicago Euphrates Archaeological Project: an interim report. *Anatolica*, 13, 37-148.

Algaze, G., Goldberg, P., Honca, D., Matney, T., Mısır, A., Rosen, A. M., Schlee, D., and Somers, L. (1995). Titriş Höyük, A Small EBA Urban Center in SE Anatolia. *Anatolica*, 21, 13-64.

Algaze, G., Greenfield, H., Hald, M. M., Hartenberger, B., Irvine, B., Matney, T., Nishimura, Y., Pornelle, J., and Rosen, S. A. (2021). Early Bronze Age Urbanism in Southeastern Anatolia and Upper Mesopotamia. *Anatolica*, 47, 1–70.

Allcock, S.L. (2017). Long-term socio-environmental dynamics and adaptive cycles in Cappadocia, Turkey during the Holocene. *Quaternary International*, 446, 66-82.

Allen, S. E. (2019). Context and contents: Distinguishing variation in archaeobotanical assemblage formation processes at Early Halaf Fistıklı Höyük, Turkey. *Vegetation History and Archaeobotany*, 28, 247–262.

Alp, S. (1968). *Zylinder- und Stempelsiegel aus Karahöyük bei Konya* (Türk Tarih Kurumu Yayinlari 26). Türk Tarih Kurumu Basımevi.

Alp, S. (1991a). *Maşat-Höyük'te Bulunan Çivi Yazılı Hitit Tabletleri/Hethitische Keilschrifttafeln aus Maşat-Höyük* (Türk Tarih Kurumu yayınları 34). Türk Tarih Kurumu Basımevi.

Alp, S. (1991b). *Hethitische Briefe Aus Masat-Hoyuk* (Türk Tarih Kurumu Yayinlari 35). Türk Tarih Kurumu Basımevi.

Alshawish, D. (2018). *Vicia ervilia (bitter vetch) from Late Neolithic-Chalcolithic Tepecik-Çiftlik (Turkey): Food and/or Fodder* (Master Thesis). University of Leiden, Leiden.

Alvaro, C., Sadori, L., Masi, A., and Susanna, F. (2010). Timber use at the end of the 4th Millennium BC at Arslantepe, in: Frangipane, M. (ed.), *Economic Centralisation in Formative States: The Archaeological Reconstruction of the Economic System in 4th Millennium Arslantepe* (Studi Di Preistoria Orientale), Sapienza Università di Roma, Dipartimento di scienze storiche archeologiche e antropologiche dell'antichità, pp. 81–93.

Anderberg, A.-L. (1994). *Atlas of Seeds and Small Fruits of Northwest-European Plant Species. Part 4: Resedaceae-Umbelliferae.* Swedish Museum of Natural History

Anderson, S. and Ertug-Yaras, F. (1998). Fuel Fodder and Faeces: An Ethnographic and Botanical Study of Dung Fuel Use in Central Anatolia. *Environmental Archaeology*, 1(1), 99-109.

Araus, J. L., Ferrio J. P., Voltas. J., Aguilera M. and Buxo, R. (2014). Agronomic conditions and crop evolution in ancient Near East agriculture. *Nature Communications*, 5.

Archi, A. (1973). Bureaucratie et communautés d'hommes libres dans le système économique Hittite. In: E. Neu and C. Rüster (eds), *Festschrift Heinrich Otten*, Harrassowitz, 17-23.

Argant, J. (2003). Données palynologiques. In: B. Geyer, and J. Lefort (eds), *La Bithynie ai Moyen Age* (Realites Byzantines 9), Editions P. Lathielleux, 176-199.

Arnhold, S. (2009). *Das hethitische Gebäude E auf der Akropolis von Kuşaklı* (Kuşaklı-Sarissa 4). Marie Leidorf.

Aslan, F. (2012). *Tatarlı Höyük (Ceyhan/Adana) kazısı helenistik dönem tabakaları ve çöp çukurlarından elde edilen bitkisel kalıntıların arkeobotanikselyönden değerlendirilmesi* (Master Thesis). Çukurova Üniversitesi, Adana.

Aslan, F., Çakan, H., and Girginer, K. S. (2014). Tatarlı Höyük (Ceyhan/Adana) Kazısı Hellenistik Dönem Tabakalarına Ait Arkeobotaniksel Bulgular. *Arkeometri Sonuçları Toplantısı*, 29, 99–106.

Asouti, E. (2003). Woodland vegetation and fuel exploitation at the prehistoric campsite of Pınarbaşı, south-central Anatolia, Turkey: the evidence from the wood charcoal macro-remains. *Journal of Archaeological Science*, 30, 1185–1201.

Asouti, E. (2005). Woodland Vegetation and the Exploitation of Fuel and Timber at Neolithic Çatalhöyük: Report on the Wood-charcoal Macro-remains. In: I. Hodder (ed.), *Inhabiting Çatalhöyük: Reports from the 1995–99 Seasons*. British Institute at Ankara; McDonald Institute for Archaeological Research, 213–258.

Asouti, E. (2013). Woodland Vegetation, Firewood Management and Woodcrafts at Neolithic Çatalhöyük. In: I. Hodder (ed.), *Humans and Landscapes of Çatalhöyük. Reports from the 2000–2008 Seasons*, British Institute at Ankara; Cotsen Institute of Archaeology Press, 129–161.

Asouti, E., and Hather, J. (2001). Charcoal Analysis and the Reconstruction of Ancient Woodland Vegetation in the Konya Basin, South-Central Anatolia, Turkey: Results from the Neolithic Site of Çatalhöyük East. *Vegetation History and Archaeobotany*, 10, 23–32.

Asouti, E., and Kabukcu, C. (2014). Holocene semi-arid oak woodlands in the Irano-Anatolian region of Southwest Asia: natural or anthropogenic?. *Quaternary Science Reviews*, 90, 158-182.

Asouti, E., Austin P. (2005). Reconstructing woodland vegetation and its exploitation by past societies, based on the analysis and interpretation of archaeological wood charcoal macro-remains. *Environmental archaeology*, 10(1), 1-18

Atalay, I. (2018). Vegetation. In: S. Kapur, E. Akça, H. Günal (eds), *The Soils of Turkey*, Springer, 15-24.

Atalay, I., Efe, R., and Öztürk, M. (2014). Ecology and classification of forest in Turkey. *Procedia*, 120, 788-805.

Audiard, B., Meignen, L., Blasco, T., Battipaglia, G., and Thery-Parisot, I. (2021a). New climatic approaches to the analysis of the middle Paleolithic sequences: Combined taxonomic and isotopic charcoal analyses on a Neanderthal settlement, Les Canalettes (Aveyron, France). *Quaternary International*, 593/594, 85-94.

Audiard, B., Ricci, G., Porraz, G., Purdue, L., Tomasso, A., et al. (2021b). Identifying short-term climatic changes through isotopic charcoal analyses early Holocene warming and the "9.3 ky" event at the Mesolithic site of La Baume de Monthiver (Var, France). In: E. Nicoud, M. Balasse, E. Desclaux, I. Théry-Parisot (eds), *Biodiversities, environments and societies since Prehistory: new markers and integrated approaches*, Éditions APDCA, 13-26.

Audiard, B., Thery-Parisot, I., Blasco, T., Mologni, C., Texier, P.-J. and Battipaglia, G. (2019). Crossing taxonomic and isotopic approaches in charcoal analyses to reveal past climates. New perspectives in Paleobotany from the Paleolithic Neanderthal dwelling-site of La Combette (Vaucluse, France). *Review of Palaeobotany and Palynology,* 266, 52-60.

Ayalon, Y. (2015). *Natural disasters in the Ottoman Empire: Plague, famine, and other misfortunes.* Cambridge University Press.

Aytuğ, B. (1988). Le mobilier funéraire du roi Midas I. In: T. Hackens, A. V. Munaut, C. Till (eds), *Wood and Archaeology: Acts of the European Symposium Held at Louvain-La-Neuve, October 1987*, Council of Europe, 357–368.

Aytuğ, B., and Gorcelioğlu, E. (1989). Gordion'daki "P" Tümülüsünde bulunmuş mobilya'lar. *Arkeometri Sonuçları Toplantısı*, 4, 49–59.

Aytuğ, B., Merev, N., and Edis, G. (1975). Sürmene-Ağaçbaşı Dolayları Ladin ormanının tarihi ve geleceği, Türkiye Bilimsel ve Teknik Araştırma Kurumu, Tarım ve Ormancılık Araştırma Grubu, proje no; TOAG-223.

Bachhuber, C. (2009). The treasure deposits of Troy: rethinking crisis and agency on the Early Bronze Age citadel. *Anatolian Studies,* 59, 1–18.

Bachhuber, C. (2012). The Anatolian Plateau. In: D.T. Potts (ed.), *A Companion to the Archaeology of the Ancient Near East*, Blackwell Publishing, 575-595.

Bachhuber, C. (2014). *Citadel and Cemetery in Early Bronze Age Anatolia* (Monographs in Mediterranean Archaeology 13). Equinox.

Badal Garcia, E. (1992). L'anthracologie préhistorique: à propos de certains problèmes méthodologiques, *Bulletin de la Société Botanique de France. Actualités Botaniques*, 139(2-4), 167-189.

Baeten, J., Marinova, E., De Laet, V., Degryse,P., De Vos, D., and Waelkens, M. (2012). Faecal biomarker and archaeobotanical analyses of sediments from a public latrine shed new light on ruralisation in Sagalassos, Turkey. *Journal of Archaeological Science* 39, 1143-1159.

Baird, D., Asouti, E., Astruc, L., Baysal, A., Baysal, E., Carruthers, D., Fairbairn, A., Kabukcu, C., Jenkins, E., Lorentz, K., Middleton, C., Pearson, J., and Pirie, A. (2013). Juniper smoke, skulls and wolves' tails. The Epipalaeolithic of the Anatolian plateau in its South-west Asian context; insights from Pınarbaşı. *Levant*, 45, 175-209.

Baird, D., Fairbairn, A., Jenkins, E., Martin, L., Middleton, C., Pearson, J., Asouti, E., Edwards, Y., Kabukcu, C., Mustafaoğlu, G., Russell, N., Bar-Yosef, O., Jacobsen, G., Wu, X., Baker, A., and Elliott, S. (2018). Agricultural origins on the Anatolian plateau. *PNAS*, 115, E3077–E3086.

Bakker, J., Kaniewski, D., Verstraeten, G., De Laet, V., and Waelkens, M. (2011). Numerically derived evidence for late-Holocene climate change and its impact on human presence in the southwest Taurus Mountains, Turkey. *The Holocene*, 22(4), 425-438.

Bakker, J., Paulissen, E., Kaniewski, D., De Laet, V., Verstraeten, G., and Waelkens, M. (2012). Man, vegetation and climate during the Holocene in the territory of Sagalassos, Western Taurus Mountains, SW Turkey, *Vegetation History and Archaeobotany*, 21, 249–266.

Balci, H., Cappers, R., Gerritsen, F., and Özbal, R. (2019). Barcin Höyük'te bitki seçimi: 2013-2015 yili arkeobotanik sonuçlarinin değerlendirilmesi. *Arkeometri Sonuçları Toplantısı* 34: 333–352.

Ballesteros Pastor, L. (2020). The Origins of the Ariobarzanid Dynasty. *Gephyra*, 20, 61-78.

Balossi Rastelli, F., Sadori, L., and Masi, A. (2010). Agriculture at Arslantepe at the end of the IV millennium BC. Did the centralised political institutions have an influence on farming practices? In: M. Frangipane (ed), *Economic Centralisation in Formative States. The Archaeological Reconstruction of the Economic System in 4th Millennium Arslantepe* (Studi di Preistoria Orientale). Sapienza Università di Roma, Dipartimento di scienze storiche archeologiche e antropologiche dell'antichità, 103-117.

Balta, E. (2017). From Ypolenion to Bolum: the viticultural transition in Cappadocia through Ottoman sources and oral tradition. In: L. Thys-Senocak (ed.). *Of vines and wines. the production and consumption of wine in Anatolian civilizations through the ages* (Ancient Near Eastern Studies, Supplement 51), Peeters, 155–168.

Balza, M. A. (2017). "Personne ne remplissait la grange de Kubaba": l'accumulation des céréales dans les inscriptions hiéroglyphiques des seigneurs locaux néo-hittites. *Res Antiquae*, 14, 1-12.

Barjamovic, G. (2008). The geography of trade Assyrian colonies in Anatolia c. 1975 – 1725 BCE and the study of early interregional networks of exchange. In: J. G. Dercksen (ed), *Anatolia and the Jazira during the Old Assyrian Period* (Old Assyrian Archives, Studies 3), Nederlands Instituut door het Nabije Osten, 87-100.

Barjamovic, G. (2011). *A Historical Geography of Anatolia in the Old Assyrian Colony Period*. Museum Tusculanum Press.

Barjamovic, G., Hertel, T., and Larsen M. T. (2012). *Ups and Downs at Kanesh: Chronology, History and Society in the Old Assyrian Period*. Eisenbrauns.

Bartha, D., and Csiszar, A. (2008). Russian olive (Elaeagnus angustifolia L.). In: Z. Botta-Dukát and L. Balogh (eds), *The most important invasive plants in Hungary*, Institute of Ecology and Botany, Hungarian Academy of Sciences, 85-93.

Başköse, I., Dural, H. (2011). The Flora of Hasan (Aksaray Region, Turkey) Mountain. *BioDiCon,* 4, 125-148.

Baton, F., Nguyen Tu, T. T., Derenne, S., Delorme, A., Delarue, F. and Dufraisse, A. (2017), Tree-ring d13C of archeological charcoals as indicator of past climatic seasonality. A case study from the Neolithic settlements of Lake Chalain (Jura, France). *Quaternary International*, 457, 50-59.

Bayer Altın, T. (2008). Melendiz ve Keçiboyduran Dağları'nda yanlış arazi kullanımının vejetasyon dağılışı uzerindeki etkileri. *Türk coğrafya dergisi*, 51, 13–32.

Bayer Altın, T., El Ouahabi, M., Fagel, N. (2015). Environmental and climatic changes during the Pleistocene–Holocene in the Bor Plain, Central Anatolia, Turkey. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 440, 564–578

Bayer Altın, T., Kayseri-Özer2, M. S., and Necati Altın, B. (2021). The Holocene terraces of the desiccated Bor Lake and Neolithic occupation in Bor Plain, Central Anatolia, Turkey. *Environmental Earth*

Sciences, 80, 525

Beal, R. H. (2011). Hittite Anatolia: A Political History. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia:* (*10,000-323 BCE*), Oxford University Press.

Beckman, G. (1995). Hittite provincial administration in Anatolia and Syria: the view from Masat and Emar. In: O. Carruba, M. Giorgieri, C. Mora (eds), *Atti del II Congresso Internationale di Hittitologia* (Studia Mediterranea 9), Gianni Iuculano Editore, 19-37.

Beckman, G. (2000). Hittite Chronology. *Akkadica*, 119/120, 19-32

Beckman, G. (2006a). The Anitta Text. in: M. W. Chavalas (ed.), *The Ancient Near East. Historical Sources in Translation* (Blackwell Sourcebooks in Ancient History), Wiley-Blackwell, 216–219

Beckman, G. (2006b). Hittite Treaties and the Development of the Cuneiform Treaty Tradition. In: J. C. Gertz, D. Prechel, K. Schmid, and M. Witte (eds), *Die deuteronomistischen Geschichtswerke. Redaktions- und religionsgeschichtliche Perspektiven zur "Deuteronomismus"-Diskussion in Tora und Vorderen Propheten* (Beihefte zur Zeitschrift für die alttestamentliche Wissenschaft 365), De Gruyter, 279-302.

Beckman, G. (2015). The Sea! The Sea! A Rite from the South of Anatolia (CTH 719). In: A. Müller-Karpe, E. Rieken, and W. Sommerfeld (Eds), *Saeculum: Gedenkschrift für Heinrich Otten anlässlich seines 100. Geburtstags*, Harrassowitz Verlag, 15-29.

Behm-Blancke, M.R. (1992). Naturwissenschaftliche Untersuchungen und lithische Industrie. *Istanbuler Forschungen* 38: 34–59.

Behre, K. E. (1992). The history of rye cultivation in Europe. *Vegetation History and Archaeobotany*, 1(3), 141-156.

Belisario, M.V., Follieri, M., and Sadori, L. (1994). Nuovi dati archeobotanici sulla coltivazione di Vitis vinifera L. ad Arslantepe (Malatya, Turchia). In: L. Milano (ed), *Drinking in Ancient Societies*, Sargon, 77-90.

Bellini, C., Mariotti-Lippi, M., Mori Secci, M., Aranguren, B., and Perazzi, P. (2008). Plant gathering and cultivation in prehistoric Tuscany (Italy). *Vegetation History and Archaeobotany*, 17(1), 103-112.

Bending, J., and Colledge, S. (2007). The Archaeobotanical Assemblages. In: N. Postgate and D. Thomas (eds), *Excavations at Kilise Tepe, 1994-98, from Bronze Age to Byzantine in Western Cilicia*, McDonald Institute for Archaeological Research, 583-595.

Benz, M., Coşkun, A., Rössner, C., Deckers, K., Riehl, S., Alt, K. W., and Özkaya, V. (2013). First evidence of an Epipalaeolithic hunter-fisher-gatherer settlement at Körtik Tepe. *Kazi Sonunclari Toplantisi*, 34: 65-78.

Benz, M., Deckers, K., Rössner, C., Alexandrovskiy, A., Pustovoytov, K., Scheeres, M., Fecher, M., Coşkun, A., Riehl, S., Alt, K.W., and Özkaya, V. (2015). Prelude to village life. Environmental data and building traditions of the Epipalaeolithic settlement at Körtik Tepe, Southeastern Turkey. *Paléorient*, 41, 9–30.

Berger, J. F., Lespez, L., Kuzucuoğlu, C., Glais, A., Hourani, F., Barra, A., and Guilaine, J. (2016). Interactions between climate change and human activities during the early to mid-Holocene in the eastern Mediterranean basins. *Climate of the Past*, 12(9), 1847-1877.

Berges, D. and Nollé, J. (2000). *Tyana. Archäologisch-historische Untersuchungen zum südwestlichen Kappadokien* (Inschriften griechischer Städte aus Kleinasien 55), Habelt.

Berggren, G. (1969). *Atlas of Seeds and Small Fruits of Northwest-European Plant Species. Part 2: Salicaceae-Cruciferae*. Swedish Museum of Natural History.

Berggren, G. (1981). *Atlas of Seeds and Small Fruits of Northwest-European Plant Species. Part 3: Cyperaceae*. Swedish Museum of Natural History.

Berlin, B. (1992). *Ethnobiological Classification. Principles of Categorization of Plants and Animals in Traditional Societies* (Princeton Legacy Library 185). Princeton University Press.

Bernabò Brea, L. (1964). *Poliochni I. Citta' Preistorica Nell'Isola di Lemnos* (Monografie della Scuola Archaeological di Atene e delle Missioni Italiane in Oriente). L'Erma di Bretschneider.

Bernbeck, R., and Pollock, S. (2003). The biography of an Early Halaf Village: Fistıklı Höyük 1999-2000. *Istanbuler Mitteilungen*, 53: 9–77.

Beug H. J. (1967). Contributions to the Postglacial vegetational history of northern Turkey. *Quaternary Palaeoecology*, 7, 349-356.

Beug, H. J., and Bottema, S. (2015). Late Glacial and Holocene vegetation history at Lake Yeniçağa, northern Turkey. *Vegetation History and Archaeobotany*, 24(2), 293-301.

Bilgen, A. N., Bilgen, Z., Okatan, M. H., Usta, R. B., and Uygun, B. (2021). New Evidence of the Cultural

Relationship between Inner North-West Anatolia and Northern Syria- Mesopotamia during the Early and Middle Bronze Ages: Exceptional Finds from Seyitömer Höyük. In: Kulakoğlu F., Michel C., Kryszat G. (Eds), *Proceedings of the 4th Kültepe International Meeting* (Subartu, 46), Brepols, 293-323.

Bilgin, T. (2018). *Officials and administration in the Hittite world* (Studies in Ancient Near Eastern Records 21). De Gruyter.

Biltekin, D., Eriş, K. K., and Bulut, S. (2021). Anthropogenic influences and climate changes in Lake Hazar (eastern Turkey) during the Late Holocene. *Quaternary International*, 583, 70-82.

Bİltekİn, D., ErİŞ, K.K., Çağatay, M.N., Ön, S.A. and Akkoca, D.B. (2018), Late Pleistocene–Holocene environmental change in eastern Turkey: multi-proxy palaeoecological data of vegetation and lake-catchment changes. *Journal Quaternary Sciences*, 33, 575-585.

Bintliff, J. (2016). Early Bronze Age Troy and the Emergence of Complex Societies in the Aegean. In: E. Pernicka, S. Ünlüsoy, and S. W. E. Blum (eds.), Early Bronze Age Troy. Chronology, Cultural Development and Interregional Contacts (Studia Troica monographien 8), Verlag Dr. Rudolf Habelt, 259-266.

Birks, H. J. B and Berglund, B. E. (2018). One hundred years of Quaternary pollen analysis 1916–2016. *Vegetation History and Archaeobotany*, 27, 271-309.

Birks, H. J. B., and Birks, H. H. (2004). *Quaternary Palaeoecology*, Blackburn Press.

Birks, H. J. B., Lotter, A. F., Juggins, S., and Smol, J. P. (2012). *Tracking environmental change using lake* *sediments: data handling and numerical techniques* (*Vol. 5*). Springer.

Bixio, R. (2012). *Cappadocia: Schede dei siti sotterranei/Records of the underground sites*. BAR Publishing.

Blaylock, S. (2009). *Tille Höyük 3.1: The Iron Age. Introduction, Stratification and Architecture* (BIAA Monograph Series 41). British Institute at Ankara.

Boardman, S. and Jones, G. (1990). Experiments on the effects of charring on cereal plant components. *Journal of Archaeological Science*, 17(1), 1-11.

Bodzek, J. A. (2014). Achaemenid Asia Minor: Coins of the Satraps and of the Great King. In: K. Dörtlük, O. Tekin, and R. Boyraz Seyhan (Eds), *First International Congress of the Anatolian Monetary History And Numismatics 25-28 February 2013*, Suna & İnan Kıraç Research Institute on Mediterranean Civilizations, 59-78.

Boffo, L. (1985). *I re ellenistici e I centri religiosi dell'Asia Minore*. La Nuova Italia.

Boffo, L. (2000). Il lessico dell'insediamento nei libri straboniani sull'Asia Minore. In: A. M. Biraschi, G. Salmeri (Eds), *Strabone e l'Asia Minore. Studi di Storia e Storiografia*, Edizioni scientifiche italiane, 115-142.

Bogaard, A., Charles, M., Filipović, D., Fuller, D. Q., Gonzalez Carretero, L., Green, L., Kabukcu, C., Stroud, E., and Vaiglova, P. (2021). The Archaeobotany of Çatalhöyük: Results from 2009–2017 Excavations and Final Synthesis. In: I. Hodder (ed), *Peopling the Landscape of Çatalhöyük: Reports from the 2009–2017 Seasons*, British Institute at Ankara, 91-123.

Bogaard, A., Charles, M., Livarda, A., Ergun, M., Filipović, D., and Jones, G. (2013). The Archaeobotany of Mid-later Occupation Levels at Neolithic Çatalhöyük. In: I. Hodder (ed), *Humans and Landscapes of Çatalhöyük. Reports from the 2000–2008 Seasons*, Cotsen Institute of Archaeology Press, 93-128.

Bogaard, A., Charles, M., Twiss, K., Fairbairn, A., Yalman, N., Filipović, D., Demirergi, G. A., Ertuğ, F., Russell, N., and Henecke, J. (2009). Private pantries and celebrated surplus: storing and sharing food at Neolithic Çatalhöyük, Central Anatolia. *Antiquity*, 83: 649–668.

Bogaard, A., Filipović, D., Fairbairn, A., Green, L., Stroud, E., Fuller, D. Q., and Charles, M. (2017). Agricultural innovation and resilience in a long-lived early farming community: the 1,500-year sequence at Neolithic to early Chalcolithic Çatalhöyük, central Anatolia. *Anatolian Studies*, 67, 1–28.

Bojnanský, V., and Fargasová, A. (2007). *Atlas of seeds and fruits of Central and East-European flora: the Carpathian Mountains region*. Springer.

Bolatti Guzzo, N. (2006). Produzione e consumo dei cereali nell'Anatolia hittita: Lo stato degli studi. In M. Marazzi (ed), *I Cereali nell'Antico Mediterraneo Preclassico*, Università Suor Orsola Benincasa, 67–81.

Bolognani, B. (2017). The Iron Age Clay Figurines from Karkemish (2011-2015 Campaigns) and the Coroplastic of the Syro-Anatolian Region (PhD Dissertation). University of Bologna.

Bonhomme, V., Ivorra, S., Lacombe, T., Evin, A., Figueiral, I., Maghradze, D., et al. (2021). Pip shape echoes grapevine domestication history. *Scientific reports*, 11(1), 1-9.

Borcard, D., Gillet, F., Legendre, P. (2011). *Numerical Ecology with R*. Springer.

Borgna, E., and Cassola Guida P. 2009. *From the Aegean to the Adriatic: Social Organizations, Modes of Exchange and Interaction in Postpalatial Times* (*12th-11th centuries BCE*). Quasar.

Börker-Klähn, J. (2007). Die Schlacht um Tuu̯anuu̯a als "Atlante Storico'. In: S.Košak, D. Groddek, M. Zorman (Eds), *Tabularia Hethaeorum: hethitologische Beiträge: Silvin Košak zum 65. Geburtstag,* (Dresdner Beiträge zur Hethitologie 25), Harrassowitz Verlag, 91–118.

Bossert, H. T. (1954-1956). Die Felsinschrift von Şırzı. *Archiv für Orientforschung*, 17, 56-70.

Bottema, S. (1995). Holocene vegetation of the Van area: palynological and chronological evidence from Söğütlü, Turkey. *Vegetation History and Archeobotany*, 4, 187-193.

Bottema, S. (2000). The Holocene history of walnut, sweet chestnut, manna-ash and plane tree in the Eastern Mediterranean. *Pallas*, 52, 35-59.

Bottema, S. and van Zeist, W. (1991). *Late Quaternary vegetation of the Near East*. (Beihefte zum Tübinger Atlas des Vorderen Orients., Reihe A, Naturwissenschaften 18). Reichert.

Bottema, S., and Woldring, H. (1984). Late Quaternary vegetation and climate of southwestern Turkey. *Paleohistoria*, 26, 123-149.

Bottema, S., Woldring, H., and Kayan, İ. (2001). The late Quaternary vegetation history of western Turkey. In: Roodenberg, J.J., Thissen, L.C. (eds), *The Ilipinar Excavations II*. Nederlands Instituut

Voor Het Nabije Oosten, 327-354.

Bottema, S., Woldring, H., Aytuğ, B. (1993-1994). Late Quaternary vegetation history of northern Turkey. *Palaeohistoria*, 35/36, 13-72.

Bouby, L., Figueiral, I., Bouchette, A., Rovira, N., Ivorra, S., Lacombe, T., et al. (2013). Bioarchaeological insights into the process of domestication of grapevine (Vitis vinifera L.) during Roman times in Southern France. *PLoS One*, 8(5), e63195.

Bouchaud, C., Jacquat, C., and Martinoli, D. (2017). Landscape use and fruit cultivation in Petra (Jordan) from Early Nabataean to Byzantine times (2nd century BC–5th century AD). *Vegetation history and archaeobotany*, 26(2), 223-244.

Bouthillier, C., Colantoni, C., Debruyne, S., Glatz, C., Hald, M. M., Heslop, D., Kozal, E., Miller, B., Popkin, P., Postgate, N., Steele, C. S., and Stone, A. (2014). Further work at Kilise Tepe, 2007-2011: refining the Bronze to Iron Age transition. *Anatolian Studies*, 64, 95-161.

Braadbaart, F. (2008). Carbonisation and Morphological Changes in Modern Dehusked and Husked Triticum Dicoccum and Triticum Aestivum Grains. *Vegetation History and Archaeobotany* 17 (1), 155-166.

Braadbaart, F. and Poole, I. (2008). Morphological, chemical and physical changes during charcoalification of wood and its relevance to archaeological contexts. *Journal of Archaeological Science*, 35(9), 2434-2445.

Braadbaart, F., Bakels, C. C., Boon, J. J. and Van Bergen, P. F. (2005). Heating Experiments Under Anoxic

Conditions On Varieties Of Wheat. *Archaeometry*, 47, 103-114.

Braadbaart, F., Boon, J. J., Veld, H., David, P. and van Bergen, P. F. (2004). Laboratory Simulations of the Transformation of Peas as a Result of Heat Treatment: Changes of the Physical and Chemical Properties. *Journal of Archaeological Science*, 31, 821-833.

Braadbaart, F., Poole, I., van Brussel, A. A. (2009). Preservation potential of charcoal in alkaline environments: an experimental approach and implications for the archaeological record. *Journal of Archaeological Science,* 36, 1672-1679.

Braidwood, R. J., Çambel, H., and Schirmer, W. (1981). Beginnings of Village-Farming Communities in Southeastern Turkey: Çayönü Tepesi, 1978 and 1979. *Journal of Field Archaeology*, 8, 249-258.

Briant, P. (2002). *From Cyrus to Alexander: a history of the Persian Empire*. Penn State Press.

Bronk Ramsey, C. (2017). OxCal 4.4 manual. http://c14.arch.ox.ac.uk/oxcalhelp/hlp_contents.html (accessed April 16, 2022).

Brouwer, W. (1972). *Handbuch des speziellen Pflanzenbaus*, Band 1. Parey.

Brown, T. A., Cappellini, E., Kistler, L., Lister, D. L., Oliveira, H. R., Wales, N., and Schlumbaum, A. (2015). Recent advances in ancient DNA research and their implications for archaeobotany. *Vegetation History and Archaeobotany*, 24(1), 207-214.

Brownson, C. L. (1922). *Anabasis* (Loeb Classical Library). William Heinemann.

Brückner, H., Müllenhoff, M., Gehrels, R., Herda, A., and Knipping, M. (2006) From archipelago to floodplain–geographical and ecological changes in Miletus and its environs during the past six millennia (Western Anatolia, Turkey). *Z. Geomorph. N.F.*, 142, 63-83.

Bryant, V. M., and Holloway, R. G. (1983). The role of palynology in archaeology. In: M. S. Schiffer (ed), *Advances in Archaeological Method and Theory*, Vol. 6, Academic Press, 191–223.

Bryant, V. M., and Holloway, R. G. (1996). New frontiers in palynology. Archaeological palynology. In: J. Jansonius and D. C. McGregor (eds), *Palynology: Principles and Applications, Volume 3. New Directions, Other Applications, and Floral History*, American Association of Stratigraphic Palynologists Foundation, 913–917.

Bryant, V. M., and Murray, R. E. (1982). Preliminary Analysis of Amphora Contents. In: G. F. Bass and F. H. Van Doorninck (eds), *Yassı Ada: A Seventh Century Byzantine Shipwreck*, Texas A&M University Press, 327-330.

Bryce, T. (2005). *The kingdom of the Hittites*. 2nd Edition. Oxford University Press.

Bryce, T. (2006). The'Eternal Treaty'from the Hittite Perspective. *British Museum Studies in Ancient Egypt and Sudan*, 1, 6-11.

Bryce, T. (2012). *The World of The Neo-Hittite Kingdoms: A Political and Military History*. Oxford University Press.

Burke, B. (2005). Textile Production at Gordion and the Phrygian Economy. In: L. Kealhofer (ed.), *The Archaeology of Midas and the Phrygians: Recent Work at Gordion*, University of Pennsylvania Museum of Archaeology and Anthropology, 69–81.

Butler, A. (1996). Trifolieae and related seeds from archaeological contexts: problems in identification. *Vegetation History and Archaeobotany*, 5(1), 157-167.

Buxó, R., and Rovira, N. (2007). Evidence for plant exploitation from PPNB and PN sites in the Middle Euphrates valley: new data from Akarçay Tepe (Turkey). In: R. Buxó and M. M. Montaña (eds), *MENMED: From the Adoption of Agriculture to the Current Landscape: Long-Term Interaction between Men and Environment in the East Mediterranean Basin*, Museu Arqueologia de Catalunya-Barcelona, 45-48.

Cahlil, N. (2019). Inside out. Sardis in the Achaemenid and Lysimachean Periods. In: A. M. Berlin and P. J. Kosmin (eds), *Spear-Won Land: Sardis from the King's Peace to the Peace of Apamea*, The University of Wisconsin Press, 11-36.

Çakan, H., Genç, E., Kavak, S., and Aslan, F. (2014). Kuriki Höyük (Batman) kazisinda ortaya çikarilan silonun arkeobotaniksel yönden değerlendirilmesi. *Arkeometri Sonuçları Toplantısı,* 29, 107–1114.

Çakan, H., Kavak, S., and Girginer, K.S. (2018). Tatarli Höyük (Ceyhan/Adana) arkeobotaniksel veriler işiğinda üzüm yetiştiriciliğine dair kanitlar. *Arkeometri Sonuçları Toplantısı*, 33, 373–384.

Çakırlar, C., and Marston, J. M. (2019). Rural agricultural economies and military provisioning at Roman Gordion (central Turkey). *Environmental Archaeology*, 24(1), 91-105.

Çaliş-Sazci, D. (2006). Die Troianer und das Meer - Keramik und Handelsbeziehungen der sog. "Maritimen Troia-Kultur". In: M. Korfmann (ed.), *Troia. Archäologie eines Siedlungshügels und* *seiner Landschaft*, Verlag Philipp von Zabern, 201-208.

Cammarosano, M. (2018). *Hittite Local Cults* (Writings from the Ancient World Series 40). SBL press.

Cammarosano, M., Weirauch, K., Maruhn, F., Jendritzki, G. and Kohl, P. L. (2019) They Wrote on Wax. Wax Boards in the Ancient Near East. *Mesopotamia*, LIV, 121-180.

Campbell, S., Carter, E., Healey, E., Anderson, S., Kennedy, A., and Whitcher, S. (1999). Emerging Complexity on the Kahramanmaras Plain, Turkey: The Domuztepe Project, 1995-1997. *American Journal of Archaeology*, 103, 395.

Canti, M. G. and Brochier, J. E. (2017). Pant Ash. In: C. Nicosia and G. Stoops (eds), *Archaeological Soil and Sediment Micromorphology*, John Wiley & Sons, 147-154.

Caple, C. and Dungworth, D. (1997). Investigations into Waterlogged Burial Environments. In: A. Sinclair, E. Slater, and J. Gowlett (eds), Archaeological Sciences, Oxbow Books, 233-240.

Capper, M. M. (2007). *Urban Subsistence in the Bronze and Iron Ages: The Palaeoethnobotany of Tell Tayinat, Turkey* (Master Thesis). Simon Fraser University.

Cappers, R. (2001). Plant remains from phase VB. A preliminary report. In: J. Roodnberg and L.C. Thissen (eds), *The Ilipinar Excavations II*, Peeters Publishing, 236–238.

Cappers, R. (2008). Plant remains from the Late Neolithic and Early Chalcolithic levels. In: J. Roodnberg and S. Arpaslan (eds), *Life and Death in a Prehistoric Settlement in Northwest Anatolia. The Ilipinar Excavations*, Nederlands Instituut Voor Het Nabije Oosten, 117-148.

Cappers, R. T. J. and Bekker, R. M. (2013). *A Manual for the Identification of Plant Seeds and Fruits*. Barkhuis.

Cappers, R. T. J. and Kooi, P. B. (2016). In memoriam – Wim van Zeist. *Palaeohistoria*, 57/58, 1-10.

Cappers, R. T., Bekker, R. M., and Jans, J. E. (2012). *Digital seed atlas of the Netherlands*. Barkhuis.

Carlquist, S. (1966). Wood anatomy of Compositae: a summary, with comments on factors controlling wood evolution. *Aliso: A Journal of Systematic and Floristic Botany*, 6(2), 25-44.

Carra, M. (2013). Tilmen Höyük: Archaeobotanical Remains from Area E. *Gaziantep Regional Project Occasional Paper*, 3, 1-3.

Carra, M. (2018). Appendix 3. The archaeobotanical evidence. In: F. Zaina (ed), *Excavations at Karkemish I. The Stratigraphic Sequence of Area G in the Inner Town* (OrientLab. Series Major), Ante Quem S.r.l., 395-399.

Carruba, O. (2003). *Anittae Res gestae*. Italian University Press.

Cassis, M., Lauricella, A. J., Tardio, K., von Baeyer, N., Coleman, S., Adcock, S. E., Arbuckle, B. S., and Smith, A. (2019). Regional patterns of transition at Çadır Höyük in the Byzantine Period. *Journal of Eastern Mediterranean Archaeology and Heritage Studies*, 7, 321–349.

Castellano, L. (2018). Staple Economies and Storage in Post-Hittite Anatolia: Considerations in Light of New Data from Niğde-Kınık Höyük (Southern Cappadocia). *Journal of Eastern Mediterranean Archaeology & Heritage Studies*, 6 (4), 259-284.

Castellano, L. (2021). A new anthracological sequence from Niğde-Kınık Höyük (Turkey): woodland vegetation and arboriculture in southern Cappadocia from the Late Bronze Age to the Ottoman Period. *Archaeological and Anthropological Sciences*, 13, 49.

Castellano, L. (forthcoming). Farming the land of Hatti: emergence and collapse of the Late Bronze Age agricultural landscape of Central Anatolia. in: L. d'Alfonso, M.G. Masetti-Rouault, R. Hawley, and I. Calini (eds), *Between the Age of Diplomacy and the First Great Empire in Ancient West Asia (1200-900 BC): Moving Beyond the Paradigm of Collapse and Regeneration*, ISAW-NYU press.

Castellano, L., Campana, D., Crabtree, P., Gürel, A., Kuzucuoğlu, C., Matessi, A., d'Alfonso, L. (forthcoming). A diachonic view on the Anatolian landcsape: environment and economies from the Bronze Age to the Ottoman Period in the Northern Tyanitis (southern Cappadocia, Turkey). In: *Proceedings of the 12th ICAANE*, Harrassowitz-Verlag.

Çavuşoğlu, R., Gökce, B., and Işık, K. (2014). The Craftsmen and Manufacturers in the Urartian Civilization. *Anatolica*, 40, 23-45.

Chabal, L. (1988). Pourquoi et comment prelever les charbons de bois pour la periode antique: les methodes utilisees sur le site de Lattes (Herault). In: Py, M. (ed), *Melanges d'Histoire et d'Archeologie de Lattes* (Lattara 1), Edition de l'Association pour la Recherche archeologique en Languedoc Oriental, 187-222.

Chabal, L. (1992). La représentativité paléo-écologique des charbons de bois archéologiques issus du bois de feu. *Bulletin de la Société Botanique de France. Actualités Botaniques*, 139(2-4), 213-236.

Chabal, L., Fabre, L., Terral, J. F. and Thery-Pariot I. (1999). L'anthracologie. In: C. Bourquin-Mignot, J. E. Brochier and L. Chabal (eds), *La Botanique*, Errance, 43-104.

Challinor, D., and de Moulins, D. (2013). Charred Plant Remains. In: W. Aylward (ed), *Excavations at Zeugma. Conducted by Oxford Archaeology*, The Packard Humanities Institute, 411-432.

Charbonneaux, J., Martin, R. and Villard, F. (1997). *La Grecia Ellenistica 330-50 a.C.* 10th Edition. Biblioteca Universale Rizzoli.

Charles, M. (1998). Fodder From Dung: the Recognition and Interpretation of Dung-Derived Plant Material from Archaeological Sites. *Environmental Archaeology*, 1(1), 111-122.

Charles, M., Filipovic, D., and Bogaard, A. (2010). Identification criteria for barley rachis: distinguishing two-from six-row and naked from hulled barley. In *15th Conference of the International Work Group for Palaeoethnobotany* (Terra Nostra, Vol. 2).

Chernoff, M. C., and Taska, M. H. (1996). Preliminary Report on Botanical Remains from Çadır Höyük (1994 Season). *Anatolica*, 22, 159-179.

Chiarucci, A., Bacaro, G., Rocchini, D. and Fattorini, L. (2008). Discovering and rediscovering the sample-based rarefaction formula in the ecological literature. *Community Ecology*, 9(1), 121-123.

Childe, V. G. (1950). The urban revolution. *The town planning review*, 21(1), 3-17.

Çiçek, I. (2003). The statistical analysis of precipitation in Ankara, Turkey. *F.Ü.Sosyal Bilimler Dergisi*, 13 (1): 1-20.

Çifci, A., and Greaves, A. M. (2013). Urartian irrigation systems: a critical review. *Ancient Near Eastern Studies*, 50, 191-214.

Çilingir, C. (2009). *Crop Processing in the Early Bronze Age Houses of İkiztepe: Identification and Analysis of Archaeobotanical Remains* (MA thesis), Middle Eastern Technical University, Ankara.

Çınaroğlu, A., and Çelik, D. (2010). *Atatürk & Alaca Höyük*. Ekici Form Ofset.

Çınaroğlu, Y. (1987). Kemerhisar-Ambartepe 1986 kazısı. *Kazı Sonuçları Toplantısı*, 9(1), 351-360.

Çizer, Ö. (2006). *Archaeobotanical macro remains from Late Bronze Age Kinet Höyük and Tell Atchana (Alalakh) in southern Turkey: Economical and environmental considerations*. (Master Thesis). Eberhard-Karls Universität Tübingen, Tübingen.

Çizer, Ö. (2015). *Archaeobotanical investigations of plant cultivation and husbandry practices at the Early Bronze Age settlement Küllüoba in West-Central Turkey: Considerations on environment, climate and economy*. British Archaeological Reports.

Cleymans, S, Daems, D., De Cupere, B., Marinova, E., and Poblome, J. (2017). A Taste of Time. Foodways and Cultural Practices in Late Achaemenid-Early Hellenistic Düzen Tepe (SW Anatolia). *Herom*, 6, 63-96.

Cline, E. H. (2014) *1177 B.C.: The Year Civilization Collapsed* (Turning Points in Ancient History, 1) Princeton University Press.

Çolak, A. H. and Rotherham I. D. (2006) A Review of the Forest Vegetation of Turkey: its Status Past and

Present and its Future Conservation. *Biology And Environment: Proceedings Of The Royal Irish Academy*, 106B (3), 343-354.

Colledge, S. (2001). Contextual Analysis of the Use of Space at Two Near Eastern Bronze Age Sites. Part 4: Final Report on the Archaeobotanical Analyses. In: R. J. Matthews and N. Postgate (eds), *Contextual Analysis of the Use of Space at Two Near Eastern Bronze Age Sites* [data-set], York: Archaeology Data Service [distributor] https://doi.org/10.5284/1000206

Collins, P. E., Rust, D. J., Bayraktutan, M. S., and Turner, S. D. (2005). Fluvial stratigraphy and palaeoenvironments in the Pasinler Basin, eastern Turkey. *Quaternary International*, 140, 121-134.

Corti, C. (2018). The Knowledge of Viticulture in Hittite Anatolia: An Interdisciplinary Approach. *Die Welt des Orients*, 48(2), 285-298.

Corti, C. (2020). The Grain of the King: Agricultural Landscape of the Hittite Festival and Land Management in Late Bronze Age Anatolia and the Northern Levant. In: S. Görke, C. W. Steitler, E. Rieken, and D. Schwemer (eds), *Cult, Temple, Sacred Spaces: Cult Practices and Cult Spaces in Hittite Anatolia and Neighbouring Cultures. Proceedings of the First International HFR Symposium, Mainz, 3–5 June 2019* (Studien Zu Den Bogazkoy-Texten), Harrassowitz. 231-252.

Coşkun, A., Benz, M., Rössner, C., Deckers, K., Riehl, S., Alt, K. W., and Özkaya, V. (2012). New Results on the Younger Dryas Occupation at Körtik Tepe. *Neo-Lithics*, 1/12, 25-32.

Crabtree, P. J., and Campana, D. V. (2014). Animal use at medieval Kınık Höyük, a 12th – 13th century site in Southern Cappadocia, Turkey. In: S. S. Stull (ed), *From West to East: Current Approaches to Medieval Archaeology*. Cambridge Scholars Publisher, 155-162.

Crabtree, P. J., and Campana, D. V. (2016). Animal Bone Remains from the Site of Kınık Höyük, Southern Cappadocia, Turkey: Animal Husbandry and Hunting Practices during the Iron Age, Hellenistic, and Medieval periods. In: R. A. Stucky, O. Kaelin, and H.-P. Mathys (eds), *Proceedings of the 9th International congress on the Archaeology of the Ancient Near East*, Harrassowitz Verlag. vol. 2, 133-139.

Crabtree, P. J., Campana, D. V., Trameri, A., Highcock, N., and d'Alfonso, L. (2018). Subsistence and ritual: a note on the Achaemenid faunal remains from the site of Kinik Höyük, Southern Cappadocia, Turkey. In: *Archaeozoology of the Near East XII: Proceedings of the 12th International Symposium of the ICAZ Archaeozoology of Southwest Asia and Adjacent Areas Working Group, Groningen Institute of Archaeology, June 14-15 2015*, University of Groningen, the Netherlands, Barkhuis, 185-190.

Cushing, E. J. (1967). Evidence for differential pollen preservation in late Quaternary sediments in Minnesota. *Review of Palaeobotany and Palynology*, 4(1-4), 87-101.

Czajkowska, B. I., Bogaard, A., Charles, M., Jones, G., Kohler-Schneider, M., Mueller-Bieniek, A., et al. (2020). Ancient DNA typing indicates that the "new" glume wheat of early Eurasian agriculture is a cultivated member of the Triticum timopheevii group. *Journal of Archaeological Science*, 123, 105258.

Czichon, R. M. and Mielke, D. P. (2020). Archäologische Forschungen am Oymaağaç Höyük/Nerik 2019. *Mitteilungen der Deutschen Orient-Gesellschaft*, 152, 155–189.

Czichon, R. M., Klinger, J., Breuer, P., Erbeek, J., Fox, S., Marinova, E., Marquardt, H., von der Osten, H., Reichmuth, S., Riehl, S., and Johannsen, T. (2011). Archäologische Forschungen am Oymaağaç Höyük/Nerik (?) in den Jahren 2007–2010. *Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin*, 143, 169-250.

Czichon, R. M., Klinger, J., Hnila, P., Mielke, D. P., Behrendt, S., Böhm, H., Breuer, M., Forster, C., Griggs, C., Klein, M., Koch, M., Kunst, G. K., Lehmann, M., Lorentzen, B., Manning, S. W., Marklein, K., Purschwitz, C., Rössner, V., Tappert, C., and Valsecchi Gillmeister, M. A. (2019.) Archäologische Forschungen am Oymaağaç Höyük/Nerik 2016-2018. *Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin*, 151, 37-200.

Czichon, R. M., Klinger, J., Hnila, P., Mielke, D. P., Böhm, H., Forster, C., Griggs, C., Kähler, M., Kunst, G. K., Lehmann, M., Lorentzen, B., Manning, S., Marklein, K., Marquardt, H., Reichmuth, S., Richter, J., Rössner, C., Sadıklar, B., Seufer, K., Sobott, R., Traub-Sobott, I., von der Osten-Woldenburg, H., Weber, M., Wolter, H., and Ali Yılmaz, M. (2016). Archäologische Forschungen am Oymaağaç Höyük/Nerik 2011-2015. *Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin*, 148, 5-141.

d'Agostino, A., Mazzoni, S., and Osi V. (2021). Excavations at Uşaklı Höyük: Recent Results. In: S. R. Steadman and G. McMahon (eds). *The Archaeology of Anatolia, Volume IV: Recent Discoveries (2018–2020),* Cambridge Scholar Publishing, 56-74.

d'Alfonso L., Basso, E., Castellano, L., Mantovan, A. and Veruani, P. (2022). Regional exchange and exclusive elite rituals in Iron Age Central Anatolia: dating, function, and circulation of the "Alişar-IV ware". *Anatolian Studies*, in print.

D'Alfonso L., Ergurer, H., Trameri, A., Justement, K., Mantovan, A., Lovejoy, N., De Pietri, M., Matessi, A., Castellano, L., Dalkilic, E., Casagrande, R., Zamperini, E., Cinieri, V., and Morandotti, M. (2018). Archaeological Excavations at Kınık Höyük, 2017: Excavation Report. *Kazı Sonuçları Toplantısı*, 40, 569-590.

d'Alfonso, L. (2010a). "Servant of the King, Son of Ugarit, and Servant of the Servant of the King": RS 17.238 and the Hittites. In: Y. Cohen, A. Gilan, and J. L. Miller (eds), *Pax Hethitica: Studies on the Hittites and their Neighbours in Honour of Itamar Singer* (Studien zu den Bogazköy-Texten 51), Harrassowitz, 67-86.

d'Alfonso, L. (2019). War in Anatolia in the Post-Hittite Period: The Anatolian Hieroglyphic Inscription of Topada Revised. *Journal of Cuneiform Studies*, 71, 133-152.

d'Alfonso, L. (2020). An age of experimentation: New thoughts on the multiple outcomes following the fall of the Hittite empire after the results of the excavations at Niğde-Kınık Höyük (south Cappadocia). In: S. De Martino and E. Devecchi (eds), *Anatolia between the 13th and the 12th century BC* (Eothen 23), LoGisma, 96-116.

d'Alfonso, L., and Castellano, L. (2018). Kınık Höyük in South Cappadocia: Addendum to: A Comparative Stratigraphy of Cilicia. *Altorientalische Forschungen*, 45, 84-93.

d'Alfonso, L., and Matessi, A. (2021). Extracting Cohesion. Fiscal Strategies in the Hittite Staple Economy. In: J. Valk and I. Soto Marín (eds), *Ancient Taxation. The Mechanics of Extraction in Comparative Perspective*, New York University Press, 128-159.

d'Alfonso, L., and Mora, C. (2008). Viaggi anatolici dell'Università di Pavia: Rapporto preliminare della seconda campagna di ricognizione archeologica nella Tyanide settentrionale. *Athenaeum*, 96(1/2), 825-841.

d'Alfonso, L., and Mora, C. (2009). Viaggi anatolici dell'Università di Pavia: Rapporto preliminare della terza campagna di ricognizione archeologica nella Tyanide settentrionale. *Athenaeum*, 97(1/2), 645-655.

d'Alfonso, L., and Mora, C. (2010). Archaeological Survey in Northern Tyanitis. In: *Proceedings of the 6th International Congress of the Archaeology of the Ancient Near East,* Vol. 5, 123-137.

d'Alfonso, L., and Mora, C., (2013). Missione archeologica a Kınık Höyük. Uno sguardo d'insieme a conclusione della seconda campagna di scavo (2012). *Athenaeum*, 101(2), 693-708.

d'Alfonso, L., Ergürer, A., Castellano, L., Highcock, N., Lanaro, A., Matessi, A., and Trameri, A. (2016). Excavations at Kınık Höyük, 2015. *Kazı Sonuçları Toplantısı*, 38(3), 333-342.

d'Alfonso, L., Trameri, A., Mantovan, A., Lovejoy, N., Castellano, L., Dalkiliç, E., Casagrande, R., Highcock, N., Yolaçan, and B., Derada, M. (2019). Archaeological excavations at Niğde Kınık Höyük (TR): excavation report 2018. *Kazı Sonuçları Toplantısı*, 41(3), 463-485.

d'Andrea, A. C. and Haile, M. (2002). Traditional emmer processing in highland Ethiopia. *Journal*

Ethnobiology, 22(2), 179-217.

Dabeer, S., Rather, M. A., Rasool, S., Rehman, M. U., Alshahrani, S., Jahan, S., at al. (2022). History and traditional uses of black seeds (Nigella sativa). In: A. Khan, and M. Rehman (eds), *Black Seeds* (*Nigella Sativa*), Elsevier, 1-28.

d'Alfonso, L. (2010b). Geo-Archaeological Survey in Northern Tyanitis and the Ancient History of Southern Cappadocia. In: L. d'Alfonso, M. E. Balza, C. Mora (Eds), *Geo-Archaeological Activities in Southern Cappadocia, Turkey*. Italian University Press, 27-54.

d'Alfonso, L. (2013). Excavations at Kınık Höyük: A Preliminary Report on the First Campaign (Aug.–Oct. 2011). *Kazı Sonuçları Toplantısı*, 34, 387–97.

d'Alfonso, L., and Ergürer, H. (2014). Kınık Höyük 2011–2012 Yılı Kazıları. *Kazı Sonuçları Toplantısı*, 35, 36-52.

D'Alfonso, L., and Mora, C. (2007). " Viaggi anatolici" dell'Università di Pavia: Rapporto preliminare della prima campagna di ricognizione archeologica nella Tyanide settentrionale. *Athenaeum*, 95(2), 819-836.

d'Alfonso, L., and Payne, A. (2016). The Paleography of Anatolian Hieroglyphic: New Perspectives. *Journal of Cuneiform Studies*, 68, 107–27.

d'Alfonso, L., Yolaçan, B., Castellano, L., Highcock, N., Casagrande, C., Gorrini, M.E., and Trameri, A. (2020). Niğde Kınık Höyük: New evidence on Central Anatolia during the first millennium BCE. *Near Eastern Archaeology*, 83(1), 16-29.

d'Alfonso, L., Gorrini, M. E., and Mora, C. (2014). Archaeological Excavations at Kınık Höyük: Preliminary Report of the Third Campaign (2013). *Athenaeum,* 102, 565-85.

d'Alfonso, L., Gorrini, M. E., and Mora, C. (2015). Archaeological Excavations at Kınık Höyük, Niğde: Preliminary Report of the Fourth Campaign (2014). *Athenaeum*, 103, 619-40.

d'Alfonso, L., Gorrini, M. E., and Mora, C. (2016). The Early Iron Age and the Hellenistic Period at Kinik Höyük, South Central Anatolia: Report of the 5th Campaign (2015). *Athenaeum*, 104, 598-612.

d'Alfonso, L., Gorrini, M. E., and Mora, C. (2017). Archaeological Excavations at Kınık Höyük, Niğde (Campaign 2016). The 5th–1st Century BCE Levels, and the End of the Occupation of the Citadel. *Athenaeum,* 105, 742-51.

d'Alfonso, L., Gorrini, M. E., and Mora, C. (2018). A Golden Pendant for a Goddess. New Evidence from the Sanctuaryo of Nigde-Kinik Höyuk, South Cappadocia. *Athenaeum*, 106, (2), 491-515.

d'Alfonso, L., Highcock, N., Lanaro, A., Matessi, A., Teksas, M., Tomassini Pieri, B. M., and Trameri, A. (2015). Kınık Höyük 2013 Yılı Kazıları. *Kazı Sonuçları Toplantısı*, 36, 489-516.

d'Altroy, T. N., and Earle, T. K. (1985). Staple Finance, Wealth Finance, and Storage in the Inka Political Economy. *Current Anthropology*, 26, 187–206.

Davis, M. B., 2000, Palynology after Y2K–understanding the source area of pollen in sediments. *The Annual Review of Earth and Planetary Sciences*, 28, 1–18.

Davis, O. K. (1994). *Aspects of Archaeological Palynology: Methodology and Applications*. Contributions

Series, Number 29. American Association of Stratigraphic Palynologists Foundation.

Davis, P. H. (1965-1985). *Flora of Turkey and the East Aegean Islands*. Edinburg University Press.

De Cupere, B., Frémondeau, D., Kaptijn, E., Marinova, E., Poblome, J., Vandam, R., and van Neer, W. (2017). Subsistence economy and land use strategies in the Burdur province (SW Anatolia) from prehistory to the Byzantine period. *Quaternary International*, 436, 4–17.

de Martino, S. (2022). Hatti: From Regional Polity to Empire. In S. de Martino (ed), *Handbook Hittite Empire. Power Structure*s, De Gruyter, 205-270

De Moulins, D. (1993). Les restes de plantes carbonisées de Cafer Höyük. *Cahiers de I'Euphraie*, 7, 191–234.

De Moulins, D. (1997). *Agricultural Changes at Euphrates and Steppe Sites in the Mid-8th to the 6th Millennium B.C.* British Archaeological Reports.

Deckers, K., 2010. Anthracological Research on Charcoal Samples from Atchana. In: A. Yener (ed.), *Tell Atchana, Ancient Alalakh. The 2003-2004 Excavations Seasons*, Koç *Üniversitesi* Yayınları, 137–139.

Deckers, K., and Pessin, H. (2010). Vegetation development in the Middle Euphrates and Upper Jazirah (Syria/Turkey) during the Bronze Age. *Quaternary Research*, 74, 216–226.

Dedeoğlu, F., and Abay, E. (2014). Beycesultan Höyük Excavation Project: New Archaeological Evidence from Late Bronze Age Layers. *Arkeoloji Dergisi*, 17, 1-39.

del Monte, G. (1995). I testi amministrativi da Masat Höyük/Tapika. *Orientis Antiqui Miscellanea*, 2: 89-138.

Del Monte, G. (2008). *Le gesta di Suppiluliuma. Traslitterazione, traduzione e commento*. Pisa University Press.

Dercksen, J. G. (2008a). Observations on land use and agriculture in Kaneš. In: C. Michel (ed), *Old Assyrian studies in memory of Paul Garelli* (Old Assyrian Archives, Studies, Volume 4), Nederlands Instituut voor het Nabije Oosten, 140-157.

Dercksen, J. G. (2008b). Subsistence, surplus and the market for grain and meat at ancient Kanesh. *Altorientalische Forschungen*, 35(1), 86-102.

Dercksen, J. G. (2014). The Old Assyrian Trade and its Participants. In: H. D. Baker and M. Jursa (eds), *Documentary Sources In Ancient Near Eastern And Greco-Roman Economic History*, Oxbow Books, 59-112.

Deza-Araujo, M., Morales-Molino, C., Tinner, W., Henne, P. D., Heitz, C., Pezzatti, G. B., et al. (2020). A critical assessment of human-impact indices based on anthropogenic pollen indicators. *Quaternary science reviews*, 236, 106291.

Diakonoff, I. M. (1967). Die hethitische Gesellschaft. *Mitteilungen des Instituts für Orientforschung*, 13, 313-366

Diakonoff, I. M. (1982). The structure of Near Eastern Society before the Middle of the 2nd Millennium B. C.. *Oikumene*, 3, 7-100.

Dickmann, D., and Kuzovkina, Y. A. (2014). Poplars and Willows in the World. In: J. Richardson, and J. G. Isebrands (eds), *Poplars and Willows, Trees for Society and the Environment*, FAO and CABI, 8-91.

Diffey, C., Neef, R., and Bogaard, A. (2017). The archaeobotany of large-scale hermetic cereal storage at the Hittite capital of Hattusha. In: A. Schachner (ed.), *Innovation versus Beharrung: Was Macht Den Unterschied Des Hethitischen Reichs Im Anatolien Des 2. Jahrtausends v. Chr.?,* Ege Yayinlari, 1-15.

Diffey, C., Neef, R., Seeher, J. and Bogaard, A. (2020). The agroecology of an early state: new results from Hattusha. *Antiquity* 94(377), 1204-1223.

Dignas, B. (2002). *Economy of the sacred in Hellenistic and Roman Asia Minor*. OUP Oxford.

Dimbleby, G. W. (1957). Pollen Analysis of Terrestrial Soils. *The New Phytologist*, 56(1), 12-28.

Dincauze, D. F. (2010). *Environmental Archaeology*. Cambridge University Press

Dinçol, B. (1994). New Archaeological and Epigraphical Finds from Ivriz: A Preliminary Report. *Tel Aviv*, 21(1), 117-128.

Dinçol, B., (2006) Über die Probleme der absoluten Datierung der Herrschaftperioden der hethitischen Könige nach den philologischen und glyptischen Belegen. *Byzas*, 4, 19-32

Divon, S. A. (2008). A survey of the textual evidence for 'food shortage' from the Late Hittite Empire. In: L. d'Alfonso, C. Yoram, S. Dietrich (eds), *The City of Emar among the Late Bronze Age Empires.*

History, Landscape, and Society, Verlag, 101-109.

Dix, W. (1938). [untitled]. In: H. Z. Kosay, *Alaca Höyük hafriyati 1936*, Türk Tarih Kurumu Yayınlarından, 179.

Dix, W. (1944). [untitled]. In: H. Z. Kosay, *Ausgrabungen von Alaca Höyük*, Türk Tarih Kurumu, 187.

Doğan, Y., Baslar, S., Ay, G., and Mert, H. H. (2004). The use of wild edible plants in western and central Anatolia (Turkey). *Economic botany*, 58(4), 684-690.

Doğanay, O. (2019). *Tyana: Kazi ve Araştirmalar I*. Arkeoloji Ve Sanat Yayinlari.

Donbaz, V. (1996). Kültepe tabletleri ısıgında i.ö. 2000–1760 yıllarında Anadolu'nun sosyal yapısı. *1995 Yılı Anadolu Medenityetleri Müzesi Konferansları*, 177-194.

Donbaz, V. (2005). An Old Assyrian Treaty from Kültepe. *Journal of cuneiform studies*, 57(1), 63-68.

Dörfler, W., Neef, R., and Pasternak, R. (2000). Untersuchungen zur Umweltgeschichte und Agrarökonomie im Einzugsbereich hethitischer Städte. *Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin*, 132, 67–380.

Drake, B. L. (2012). The influence of climatic change on the Late Bronze Age Collapse and the Greek Dark Ages. *Journal of Archaeological Science*, 39: 1862-1870.

Dufraisse, A. and Garcia Martinez, M. S. (2011). Mesurer les diamètres du bois de feu en anthracologie. Outils dendrométriques et interprétation des données. *Anthropobotanica*, 2, 1-18.

Dufraisse, A. Coubray, S., Girardclos, O., Nocus, N., Lemoine, L., et al. (2018). Anthracotypology as a key approach to past firewood exploitation and woodland management reconstructions. Dendrological reference dataset modelling with dendro-anthracological tools. *Quaternary International*, 463, 232-249.

Dufraisse, A., Coubray, S., Picornell-Gelabert, L., Alcolea, M., Girardclos, O., Delarue F., and Nguyen Tu T.-T. (2022). Taming Trees, Shaping Forests, and Managing Woodlands as Resources for Understanding Past Societies. Contributions and Current Limits of Dendro-Anthracology and Anthraco-Isotopy. Frontiers in Ecology and Evolution, 10, 823968.

Dupont-Summer, A., and Robert, L. (1964). *La déesse de Hiérapolis Castabala* (*Cilicie*) (Bibliothèque archéologique et historique de l'Institut français d'archéologie d'Istanbul 16). A. Maisonneuve.

Düring, B. (2011). Fortifications and fabrications: Reassessing the emergence of fortifications in Prehistoric Asia Minor. In: B. S. During, A. Wossink, and P. M. M. G. Akkermans (eds), *Correlates of Complexity: Essays in Archaeology and Assyriology Dedicated to Diederik J. W. Meijer in Honour of his 65th Birthday*, Nederlands Instituut voor het Nabije Oosten 69,85.

Düring, B. (2012). *The prehistory of Asia Minor: from complex hunter-gatherers to early urban societies*. Cambridge University Press

Dusinberre, E. R. (2013). *Empire, Authority, and Autonomy in Achaemenid Anatolia*. Cambridge University Press.

Dusinberre, E. R. (2019). The collapse of empire at Gordion in the transition from the Achaemenid to the Hellenistic world. *Anatolian Studies*, 69, 109-132.

Easton (2002). *Schliemann's Excavations at Troy 1870-1873* (Studia Troica Monographien 2). Verlag.

Eastwood, W. J., Leng, M. J., Roberts, N., and Davis, B. (2007). Holocene climate change in the eastern Mediterranean region: a comparison of stable isotope and pollen data from Lake Gölhisar, southwest Turkey. *Journal of Quaternary Science*, 22(4), 327-341.

Eastwood, W. J., Roberts, N., and Lamb, H. F. (1998). Palaeoecological and archaeological evidence for human occupance in southwest Turkey: The Beyşehir Occupation Phase. *Anatolian Studies*, 48, 69-86.

Eastwood, W. J., Tibby, J., Roberts, N., Birks, H. J. B., and Lamb, H. F. (2002). The environmental impact of the Minoan eruption of Santorini (Thera): statistical analysis of palaeoecological data from Golbisar, southwest Turkey. *The Holocene*, 12(4), 431-444.

Eastwood, W.J., Fairbairn, A., Stroud, E., Roberts, N., Lamb, H., Yiğitbaşıoğlu, H., Şenkul, C., Moss, A., Turner, R., and Boyer, P. (2018). Comparing pollen and archaeobotanical data for Chalcolithic cereal agriculture at Çatalhöyük, Turkey. *Quaternary Science Reviews*, 202, 4-18.

Ebeling, E. and Meissner, B. (1938). *Reallexikon der Assyriologie*, Band 2, de Gruyter

Edel, E. (1994). *Die ägyptisch-hethitische Korrespondenz aus Boghazköi in babylonischer und hethitischer Sprache* (Rheinisch-Westfälische Akademie der Wissenschaften Abhandlung 77). Westdeutscher Verlag.

Edwards, K. J. (2016). Using space in cultural palynology: the value of the off-site pollen record. In *Modelling Ecological Change*, Routledge, 69-81.

Efe, T. (2007). The Theories of the 'Great Caravan Route' between Cilicia and Troy: The Early Bronze Age III Period in Inland Western Anatolia, *Anatolian Studies*, 57, 47-64

Effenberger, H. (2018). The plant economy of the Northern European Bronze Age—more diversity through increased trade with southern regions. *Vegetation History and Archaeobotany*, 27(1), 65-74.

Eken, G., Bozdoğan, M. Isfendiyaroğlu, S., Kilic, D. T., and Lise Y. (2006). *Türkiye'nin Önemli Doğa Alanları.* Doğa Derneği.

Elgavish, D. (2003). Extradition of Fugitives in International Relations in the Ancient Near East. *Jewish Law Association Studies*, XIV, 33-58.

Emery-Barbier, A., and Thiébault, S. (2005). Preliminary conclusions on the Late Glacial vegetation in south-west Anatolia (Turkey): the complementary nature of palynological and anthracological approaches. *Journal of Archaeological Science*, 32, 1232–1251.

Emre, K. (1993). The Hittite Dam of Karakuyu. In: Mikasa no Miya Takahito (ed), *Essays on Anatolian Archaeology*, Harrassowitz Verlag, 1-17.

England, A., Eastwood, W. J., Roberts, C. N., Turner, R., and Haldon, J. F. (2008). Historical landscape change in Cappadocia (central Turkey): a palaeoecological investigation of annually laminated sediments from Nar lake. *The Holocene*, 18(8), 1229-1245.

England, J., Elton, H., Hadland, A., Şenkul, C., Free, P., and Eastwood, W. J. (2022) Olive Cultivation at High Altitudes in Anatolia: Exploiting Micro-Localities in Ancient Asia Minor. In: C. H. Roosevelt and J. Haldon (eds), *Winds of Changes. Environment and Society in Anatolia*, Koç University Press, 219-228.

Equini Schneider, E., Morselli, C., Spanu, M., & Vismara, C. (1997). Varia Cappadocica. *Archeologia Classica*, 49, 101–209.

Erbil, Y., and Mouton, A. (2012). Water in ancient Anatolian religions: an archaeological and philological inquiry on the Hittite evidence. *Journal of Near Eastern Studies*, 71(1), 53-74.

Erciyas, D. B., and Tatbul, M. N. (2016). Anadolu'da Ortaçağ Kazıları ve Komana. *Kazi Sonunclari Toplantisi*, 37, 611-626.

Ergun, M. (2018). Where the wild things are". Contextual insights into wild plant exploitation at Aceramic Neolithic Aşıklı Höyük, Turkey. *Paléorient*, 44, 9-28.

Ergun, M., Tengberg, M., Willcox, G., and Douche, C. (2018). Plants of Aşıklı Höyük and changes through time: First archaeobotanical results from the 2010-14 excavation seasons. In: M. Özbaşaran, G. Duru, and M. Stiner (eds), *The Early Settlement at Aşıklı Höyük, Essays in Honor of Ufuk Esin*, Ege Yayınları, 191-218.

Ergürer, A., Casagrande, R., Castellano, L., de Pietri, M., Highcock, N., Trameri, A., and d'Alfonso, L. (2017). Excavations at Kınık Höyük, 2016. *Kazı Sonuçları Toplantısı*, 39(2), 587-599.

Erkanal, H., and Özkan, T. (1999). Bakla Tepe Höyüğü kazı çalışmaları. In: T. Özkan (ed.), *Tahtalı barajı* *kurtarma kazısı projesi*, Izmir arkeoloji müzesi müdürlüğü, 12-41.

Erkul, E., Hüser, A., and Stümpel, H. (2008). Combined geophysical survey of an ancient Hittite dam: new and old high-tech. In: A., Posluschny, K. Lambers, and I. Herzog (eds), *Layers of Perception. Proceedings of the 35th International Conference on Computer Applications and Quantitative Methods in Archaeology* (*CAA*)*, Berlin, Germany, April 2–6, 2007* (Kolloquien zur Vor- und Frühgeschichte 10), Dr. Rudolf Habelt, 1-5.

Ertem, Ö (2012). Considering Famine in the Late Nineteenth Century Ottoman Empire: A Comparative Framework and Overview. In: A. G. Newby (ed.), *"The Enormous Failure of Nature": Famine and Society in the Nineteenth Century* (Studies across Disciplines in the Humanities and Social Sciences 22), Helsinki Collegium for Advanced Studies, 151-172.

Ertem, Ö (2017). Sick Men of Asia Minor in an Ailing Empire: Famine, villagers and government in missionary accounts (1873-75). *International Review of Turkish Studies*, 2(1), 72-94

Ertuğ, F. (2000) An ethnobotanical study in Central Anatolia (Turkey). *Economic Botany*, 54, 155-182.

Ertuğ, F. (2004). Wild edible plants of the Bodrum area (Muğla, Turkey). *Turkish Journal of Botany*, 28, 161-174.

Ertuğ, F. (2006). An overview of the plaited crafts of Turkey (Anatolia and Thrace). In: F. Ertuğ (ed), *Proceedings of the IVth International Congress of Ethnobotany* (ICEB 2005), Yayinlari, 297-306.

Ertuğ-Yaraş, F. (1997). *An ethnoarchaeological study of subsistence and plant gathering in Central Anatolia*. Ph.D. thesis, Washington University, St. Louis.

Evert, R. F., and Eichhorn, S. E. (2013). *Raven: biology of plants*. 8th Edition. W. H. Freeman

Ezer, S. (2014). Kültepe-Kanesh in the Early Bronze Age. In: L. Atici, F. Kulakoğlu, G. Barjamovic and A. Fairbairn (eds), *Current Research At Kültepe-Kanesh. An Interdisciplinary And Integrative Approach To Trade Networks, Internationalism, And Identity*, Lockwood Press, 5-24.

Faegri, K., and Iversen, J. (1950). *Text-book of modern pollen analysis*. Ejnar Munksgaard

Faegri, K., Kaland, P. E., and Krzywinski, K. (1989). *Textbook of pollen analysis*. Wiley.

Fahn, A., Werker, E., and Baas, P. (1986). *Wood anatomy and identification of trees and shrubs from Israel and adjacent regions.* The Israel Academy of Sciences and Humanities.

Fairbairn, A. (2002). Archaeobotany at Kaman-Kalehöyük 2001. *Anatolian Archaeological Studies,* 11, 201-212.

Fairbairn, A. (2003). Archaeobotany at Kaman-Kalehöyük 2002. *Anatolian Archaeological Studies,* 12, 151-162.

Fairbairn, A. (2004). Archaeobotany at Kaman-Kalehöyük 2003. *Anatolian Archaeological Studies*, 13, 107-120.

Fairbairn, A. (2005). A history of agricultural production at Neolithic Çatalhöyük East, Turkey. *World Archaeology*, 37, 197-210.

Fairbairn, A. (2006). Archaeobotany at Kaman-Kalehöyük 2005. *Anatolian Archaeological Studies*, 15, 133-137.

Fairbairn, A. (2014). Preliminary archaeobotanical investigations of plant production, consumption, and trade at Bronze Age Kültepe-Kanesh. In: L. Atici, F. Kulakoğlu, G. Barjamovic, and A. Fairbairn (eds), *Current Research at Kultepe-Kanesh: An Interdisciplinary and Integrative Approach to Trade Networks, Internationalism, and Identity* (the Journal of Cuneiform Studies Supplemental Series), Lockwood Press, 177-193.

Fairbairn, A. (2019a). Plant resource stores and other samples from Bademağacı Höyük. In: R. Duru and G. Umurtak (eds), *Bademağaci – I. 1993-2010 Yillari arasinda yapilan kazilarin sonuçlari. Neolitik ve Erken Kalkolitik Çağ yerleşmeleri*, Ege Yayinlari, 233-242.

Fairbairn, A. (2019b). Revision for the crop history of Aceramic Neolithic Canhassan III, Karaman, Turkey. *18th conference of the International Workgroup for Palaeoethnobotany*.

Fairbairn, A. (2021). Agriculture in the Chalcolithic and Bronze Age of Asia Minor. In: D. Hollander and T. Howe (eds), *A Companion to Ancient Agriculture*, John Wiley & Sons, 211-239.

Fairbairn, A. and Nesbitt, M. (2019). Gordon C. Hillman. 20 July 1943 to 1 July 2018. *Anatolian Studies*, 69, iii-iv.

Fairbairn, A. and Omura, S. (2005). Archaeological identification and significance of ESAG (agricultural storage pits) at Kaman-Kalehoyuk, central Anatolia. *Anatolian Studies*, 55: 15-23.

Fairbairn, A. and Weiss, E. (2009). *From Foragers to Farmers. Papers in Honour of Gordon C. Hillman*. Oxbow Books.

Fairbairn, A., and Bradley, K. (2008). Archaeobotany at Kaman-Kalehöyük 2007. *Anatolian*

Archaeological Studies, 17, 195-199.

Fairbairn, A., and Wright, N. J. (2017). Grinding, burning and trading at Kültepe: Archaeobotanical evidence for economic differences between settlements in Anatolia's Middle Bronze Age. *Subartu,* 39, 9-27.

Fairbairn, A., Asouti, E., Near, J., and Martinoli, D. (2002). Macro-botanical evidence for plant use at Neolithic Çatalhöyük South-central Anatolia, Turkey. *Vegetation History and Archaeobotany*, 11, 41-54.

Fairbairn, A., Kulakoğlu, F., and Atici, L. (2013). Archaeobotanical evidence for trade in hazelnut (Corylus sp.) at Middle Bronze Age Kültepe (c. 1950–1830 b.c.), Kayseri Province, Turkey. *Vegetation History and Archaeobotany,* 23, 167-174.

Fairbairn, A., Martinoli, D., Butler, A., and Hillman, G. (2007). Wild plant seed storage at Neolithic Çatalhöyük East, Turkey. *Vegetation History and Archaeobotany*, 16, 467-479.

Fairbairn, A., Near, J., and Martinoli, D. (2005). Macrobotanical Investigation of the North, South and KOPAL Area Excavations at Çatalhöyük East. In: I. Hodder (ed.), *Inhabiting Çatalhöyük: Reports from the 1995–99 Seasons*, British Institute at Ankara; McDonald Institute for Archaeological Research, 137-201.

Fairbairn, A., Wright, N. J., Weeden, W., Barjamovic, G., Matsumura, K., Rasch, R. (2019). Ceremonial plant consumption at Middle Bronze Age Büklükale, Kırıkkale Province, central Turkey. *Vegetation History and Archaeobotany*, 28, 327-346.

Fairbairn, A.S., Jenkins, E., Baird, D., and Jacobsen, G. (2014). 9th millennium plant subsistence in the central Anatolian highlands: new evidence from Pınarbaşı, Karaman Province, central Anatolia. *Journal of Archaeological Science*, 41, 801-812.

Fairbairn, A.S., Longford, C., Griffin, B. (2007). Archaeobotany at Kaman-Kalehöyük 2006. *Anatolian Archaeological Studies*, 16, 51–157.

Fall, P., Falconer, S. E., and Lines, L. (2002). Agricultural intensification and the secondary products revolution along the Jordan Rift. *Human ecology,* 30,(4), 445-481.

Faroqhi, S. (1982). Camels, wagons, and the Ottoman State in the Sixteenth and Seventeenth Centuries. *International Journal of Middle East Studies*, 14(4), 523-539.

Faydalı, E. (1974). Gökbez Kaya Kabartması. *Anadolu*, 18, 135-36.

Fenwick, R.S.H., and Omura, S. (2015). Smoke in the eyes? Archaeological evidence for medicinal henbane fumigation at Ottoman Kaman-Kalehöyük, Kırşehir Province, Turkey. *Antiquity*, 89, 905-921.

Ferrio, J. P., Alonso, N., Voltas, J., and Araus, J. L. (2014). Estimating grain weight in archaeological cereal crops: a quantitative approach for comparison with current conditions. Journal Archeological Sciences, 31(11), 1635-164.

Fick, S.E. and Hijmans, R. J. (2017). WorldClim 2: new 1-km spatial resolution climate surfaces for global land areas. *International Journal Climatology*, 37, 4302-4315.

Figueiral, I., Bouby, L., Buffat, L., Petitot, H., and Terral, J. F. (2010). Archaeobotany, vine growing and wine producing in Roman Southern France: the site of Gasquinoy (Béziers, Hérault). *Journal of Archaeological Science*, 37(1), 139-149.

Filipović, D. (2012). *An archaeobotanical investigation of plant use, crop husbandry and animal diet at early-mid Neolithic Çatalhöyük, Central Anatolia* (PhD dissertation). Univeristy of Oxford.

Filipović, D. (2014). *Early Farming in Central Anatolia: An archaeobotanical study of crop husbandry, animal diet and land use at Neolithic Çatalhöyük* (BAR International Series). British Archaeological Reports.

Filipović, D. (2016). Observation of "Traditional" Agriculture in Kastamonu, Turkey In Relation to the Evidence of Crop Husbandry at Neolithic Çatalhöyük, Central Anatolia. *EAP IEA*, 7, 1167-1191.

Filipović, D., Meadows, J., Corso, M. D., Kirleis, W., Alsleben, A., Akeret, Ö., et al. (2020). New AMS 14C dates track the arrival and spread of broomcorn millet cultivation and agricultural change in prehistoric Europe. *Scientific reports*, 10(1), 1-18.

Finné, M., Holmgren, K., Sundqvist, H. S., Weiberg, E., & Lindblom, M. (2011). Climate in the eastern Mediterranean, and adjacent regions, during the past 6000 years–A review. *Journal of archaeological science*, 38(12), 3153-3173.

Fiorentino, G. (2004). The Botanical View of Food and Landscape at Yumuktepe. In: I. Caneva, and V. Sevin (eds), *Mersin–Yumuktepe: a Reappraisal*, Galatina, 159-162.

Fiorentino, G. (2016). Palaeo-Vegetational Reconstructions in the Lykos Valley by Archaeobotanical

Analyses at Hierapolis. In: C. Şimşek, and F. d'Andria (eds), *Landscape and History in the Lykos Valley: Laodikeia and Hierapolis in Phrygia*, Cambridge Scholars, 219-238.

Fiorentino, G., and Solinas, F. (2008). Micro-stratigraphical and archaeobotanical approaches to investigating ash deposits in the Apollo Sanctuary in Hierapolis. *Arkeoloji Dergisi*, 89–98.

Fiorentino, G., and Ulaş, B. (2017). Agricultura e ambiente vegetale a Yumuktepe. In: I. Caneva, and G. Köroğlu (eds), *Yumuktepe. Un Viaggio Di Novemila Anni*, Ege Yayinlari, 109-114.

Fiorentino, G., D'Oronzo, C., and Solinas, F. (2012). Le ricerche archeobotaniche a Hierapolis di Frigia. Campagne 2002-2006. In: F. d'Andria, M.P. Caggia, and T. Ismaelli (eds), *Hierapolis di Frigia V. Le attività delle campagne di scavo e restauro 2004-2006*, Zero Prod. Ltd., 39-59.

Fiorentino, G., Primavera, M., and Caracuta, V. (2014). Archaeological Investigations at Mersin-Yumuktepe: Food Habits from Neolithic to Medieval Ages. In: L. Milano (ed.), *Paleonutrition and Food Practices in the Ancient Near East. Towards a Multidisciplinary Approach* (History of the Ancient Near East-Monographs), Sargon, 85-94.

Follieri, M. and Coccolini, G. B. L. (1983). Palaeoethnobotanical Study of the VI A and VI B periods of Arslantepe (Malatya, Turkey). Preliminary Report. *Origini*, 12, 599,617.

Fontugne, M., Kuzucuoğlu, C., Karabiyikoğlu, M., Hatte, C., and Pastre, J. F. (1999). From Pleniglacial to Holocene: a 14C chronostratigraphy of environmental changes in the Konya Plain, Turkey. *Quaternary Science Reviews*, 18(4-5), 573-591.

Food and Agriculture Organization of the United Nations (2011). Rural Structures in the Tropics: Design and Development. http://www.fao.org/docrep/015/i2433e/i2433e00.htm (accessed April 15, 2022).

Ford, R. I. (1979). Paleoethnobotany in American Archaeology. *Advances in Archaeological Method and Theory*, 2, 285-336.

Forlanini, M. (2017). South-Central: The Lower Land and Tarhuntašša. In: M. Weeden, and L.Z. Ullmann (Eds), *Hittite Landscape and Geography* (Handbook of Oriental Studies. Section 1 The Near and Middle East 121), Brill, 239-252

Frangipane, M. (1996). *La Nascita dello Stato nel Vicino Oriente: dai Lignacci alla Burocrazia nella Grande Mesopotamia*. Quadrante

Frangipane, M. (2007). Different types of egalitarian societies and the development of inequality in early Mesopotamia. *World Archaeology*, 39 (2), 151-176.

Frangipane, M. (2012). The Evolution and Role of Administration in Anatolia: A Mirror of Different Degrees and Models of Centralization. In: M. E. Balza, M. Giorgieri, and C. Mora (eds), *Archives, Depots, and Storehouses in the Hittite World: New Evidence and New Research. Proceedings of the Workshop Held at Pavia, June 18, 2009* (Studia Mediterranea 23), Italian University Press, 111–126.

Frangipane, M. (2018a). Different Trajectories in State Formation in Greater Mesopotamia: A View from Arslantepe (Turkey). *Journal of Archaeological Research*, 26, 3-63.

Frangipane, M. (2018b). Different forms of surplus production and use and the economic foundations of early state societies in the Mesopotamian world. In: H. Meller, D. Gronenborn, and R. Risch (eds), *Surplus without the State – Political Forms in Prehistory*, Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, 81-101.

Frangipane, M. (2018c). From a subsistence economy to the production of wealth in ancient formative societies: a political economy perspective. *Economia Politica*, 35(3), 677-689.

Frangipane, M. and Liverani, M. (2013). Neo-Hittite Melid: Continuity or Discontinuity? In: K. A. Yener (ed), *Across the Border: Late Bronze-Iron Age Relations Between Syria and Anatolia*, Peeters, 349–371.

Frangipane, M., Di Nocera, G.M., Hauptmann, A., Morbidelli, P., Palmieri, A., Sadori, L., Schultz, M., and Schmidt-Schultz, T. (2001). New Symbols of a New Power in a "Royal" Tomb from 3 000 BC Arslantepe, Malatya (Turkey). *Paléorient*, 27, 105–139.

Frank, L. (1966). Sources classiques concernant la Cappadoce. *RHA*, XXIV, 6-122.

Franz-Szabo, G. (2003-2005). Obst und Gemiise in Anatolien. *Reallexikon der Assyriologie*, 10, 22-26

French, D. (1998). Pre-and early-Roman roads of Asia Minor: The Persian royal road. *Iran*, 36(1), 15-43.

French, D. H. (1975). Excavations at Can Hasan III 1969-70. In: E. S. Higgs (ed), *Papers in Economic Prehistory*, Cambridge University Press, 181–190.

Fuks, D. and Dunseth, Z. C. (2019). Dung in the dumps: what we can learn from multi-proxy studies of archaeological dung pellets. *Vegetation History and Archaeobotany*, 30, 137-153.

Fuller, B.T., De Cupere, B., Marinova, E., Van Neer, W., Waelkens, M., and Richards, M. P. (2012). Isotopic reconstruction of human diet and animal husbandry practices during the Classical-Hellenistic, imperial, and Byzantine periods at Sagalassos, Turkey. *American Journal of Physical Anthropology*, 149, 157-171.

Fuller, D. Q. and Harvey, E. L. (2006). The archaeobotany of Indian pulses: identification, processing and evidence for cultivation. *Environmental Archaeology*, 11(2), 219-246.

Fuller, D. Q., and Stevens, C. J. (2019). Between domestication and civilization: the role of agriculture and arboriculture in the emergence of the first urban societies. *Vegetation History and Archaeobotany*, 28(3), 263-282.

Furholt, M., Grier, C., Spriggs, M., and Earle, T. (2020). Political economy in the archaeology of emergent complexity: A synthesis of bottom-up and top-down approaches. *Journal of Archaeological Method and Theory*, 27(2), 157-191.

Gaillard, M. J., Sugita, S., Bunting, J., Dearing, J., and Bittmann, F. (2008). Human impact on terrestrial ecosystems, pollen calibration and quantitative reconstruction of past land-cover. *Vegetation History and Archaeobotany*, 17, 415-418.

Gallagher, D. E. (2014). Formation Processes of the Macrobotanical Record. In: J. M. Marston, J. d'Alpoim Guedes and C. Warinner (eds), *Methods and Theory in Paleoethnobotany*, University Press of Colorado, 19-34

Gardener, C. J., McIvor, J. G., and Jansen, A. (1993). Passage of legume and grass seeds through the digestive tract of cattle and their survival in faeces. *Journal of Applied Ecology*, 63-74.

Garstang, J. (1910). *The Land of the Hittites: An Account of Recent Explorations and Discoveries in Asia Minor*. EP Dutton and Co.

Garstang, J. (1953). *Prehistoric Mersin*. Oxford University Press.

Gates, M. H. (2013a). Early Iron Age Newcomers at Kinet Höyük, Eastern Cilicia. In: A. E. Killebrew and G. Lehmann (eds), *The Philistines and Other "Sea Peoples" in Text and Archaeology*, SBL Press, 485–507.

Gates, M. H. (2013b). From Late Bronze Age to Iron Age on Syria's Northwest Frontier: Cilicia and Amuq. In: S. Mazzoni and S. Soldi (eds), *Syrian Archaeology in Perspective: Celebrating 20 Years of Excavations at Tell Afis. Proceedings of the International Meeting Percorsi di Archeologia Siriana giornate di studio, Pisa, 27–28 novembre 2006*, Edizioni ETS, 96–116.

Gelb, I. J. (1973). Prisoners of war in early Mesopotamia. *Journal of Near Eastern Studies*, 32(1/2), 70-98.

Gemici Y. (1986). Çivril (Denizli), *Sandıklı ve Dinar (Afyon) ilçeleri arasındaki Akdağ ve çevresinin flora ve vejetasyonu, Türkiye bilimsel ve Teknik Araştırma Kurumu, Temel Bilimler Araştırma Grubu*, proje no TBAG-571.

Genz, H. (2004). *Büyükkaya: 1. Die Keramik der Eisenzeit. Funde aus den Grabungskampagnen 1993 bis 1998*. Von Zabern.

Genz, H. (2005). Thoughts on the Origin of the Iron Age Pottery Traditions in Central Anatolia. In: . Çilingiroğlu and G. Darbyshire (eds), *Anatolian Iron Ages 5: Proceedings of the Fifth Anatolian Iron Ages Colloquium Held at Van, 6–10 August 2001*, British Institute at Ankara, 75-84

Genz, H. and Mielke, D. P. (2011). *Insights Into Hittite History and Archaeology* (Colloquia Antiqua 2). Peeters.

Giorgadze, G. (1998). Zum Kauf und Verkauf von Grund und Boden in der hethitischen Gesellschaft. *Altorientalische Forschungen*, 25, 95-103.

Giorgi J. (2012). The plant remains. In: C. S. Lightfoot, and E. A. Ivison (eds), *Amorium Reports 3: The Lower City Enclosure Finds Reports and Technical Studies*, Zero Prodüksiyon Kitap, 395-418.

Gismondi, A., Di Marco, G., Martini, F., Sarti, L., Crespan, M., Martínez-Labarga, C., et al. (2016). Grapevine carpological remains revealed the existence of a Neolithic domesticated Vitis vinifera L. specimen containing ancient DNA partially preserved in modern ecotypes. *Journal of Archaeological Science*, 69, 75-84.

Giusfredi, F. (2010). Sources for a Socio-Economic History of the Neo- Hittite States (Texte der Hethiter 28). Universitätsverlag.

Glatz, C. (2020). *The Making of Empire in Bronze Age Anatolia. Hittite Sovereign Practice, Resistance, and Negotiation*. Cambridge University Press.

Glatz, C., and Matthews, R. (2005). Anthropology of a frontier zone: Hittite-Kaska relations in Late Bronze Age north-central Anatolia. *Bulletin of the American Schools of Oriental Research*, 339(1), 47-65.

Godwin, H. and Tansley, A. G. (1941). Prehistoric charcoals as evidence of former vegetation, soil and climate. *Journal of Ecology*, 19, 117–126.

Goedegebuure, P., Van den Hout, T., Osborne, J., Massa, M., Bachhuber, C., and Şahin, F. (2020). TÜRKMEN-KARAHÖYÜK 1: A new Hieroglyphic Luwian inscription from Great King Hartapu, son of Mursili, conqueror of Phrygia. *Anatolian Studies*, 70, 29-43.

Goetze, A. (1940). *Kizzuwatna and the Problem of Hittite Geography* (Yale Oriental Series, Researches, XXII). Cambridge University Press.

Gökgöl, D.M. (1938). Alaca Höyük 1936 hafriyatina Çıkan tohumlar. In: H.Z. Kosay (ed.), *Alaca Höyük Hafriyati 1936*, Türk Tarih Kurumu Yayınlarından, 177-178.

Gökgöl, D.M. (1944) Samen die bei den Ausgrabungen in Alaca Höyük im Jähre 1936 gefunden worden sind. In: H.Z. Kosay (ed.), *Ausgrabungen von Alaca Höyük*, Türk Tarih Kurumu, 185-186.

Goldman, H. (1956). *From the Neolithic through the Bronze Age. Vol. 2 of Excavations at Gözlü Kule, Tarsus*. Princeton University Press.

González Carretero, L., Wollstonecroft, W., and Fuller, D. Q. (2017). A methodological approach to the study of archaeological cereal meals: a case study at Çatalhöyük East (Turkey). *Vegetation History and Archaeobotany*, 26, 415-432.

Gorham, L. D. (2000). *The Archaeobotany of the Bozburun Byzantine shipwreck* (PhD Dissertation). Texas A&M University.

Gorny, R. (1995). Viticulture in Ancient Anatolia, in: P. E. McGovern, S. J. Fleming, S. H. Katz (eds), *The Origins and Ancient History of Wine*, Gordon and Breach, 133-174.

Gorny, R. (1997). Zippalanda and Ankuwa: The Geography of Central Anatolia in the Second Millennium B. C. *Journal of the American Oriental Society*, 117 (3), 549-557.

Gorny, R. (2004). Project Reports: Alisar Regional Project. *The Oriental Institute 2003–2004 Annual Report*, 13–24.

Graham, P. J. (2011). *Ubaid Period Agriculture at Kenan Tepe, Southeastern Turkey* (PhD dissertation). University of Connecticut.

Graham, P.J., and Smith, A. (2013). A day in the life of an Ubaid household: archaeobotanical investigations at Kenan Tepe, south-eastern Turkey. *Antiquity*, 87, 405-417.

Green, L., Charles, M., and Bogaard, A. (2018). Exploring the agroecology of Neolithic Catalhoyiik, Central Anatolia. An archaeobotanical approach to agricultural intensity based on functional ecological analysis of arable weed flora. *Paleorient*, 44, 29-43.

Greenfield, T.L., and Rosenzweig, M. S. (2016). Assyrian Provincial Life: A Comparison of Botanical and Faunal Remains from Tušhan (Ziyaret Tepe), Southeastern Turkey. In: S. Bickel (ed), *Proceedings of the 9th International Congress on the Archaeology of the Ancient Near East: June 9-13, 2014, University of Basel*, Harrassowitz Verlag, 305-322.

Greenwood, D. R. (1981). The Taphonomy of Plant Macrofossils. In: S. K. Donovan (ed.), *The Process of Fossilization*, Columbia University Press, 41–169

Gregory, D. and Matthiesen, H. (2018). Deterioration and preservation of organic materials on the seabed. In: A. Fischer and L. Pedersen (eds), *Oceans of Archaeology*, Oxbow Books, 137-143.

Greig, J. (1989). *Archaeobotany* (Handbooks for Archaeologists 4). European Science Foundation.

Grimm, E. C., Maher, L. J., and Nelson, D. M. (2009). The magnitude of error in conventional bulk-sediment radiocarbon dates from central North America. *Quaternary Research*, 72(2), 301-308.

Guarcello, R., Gaglio, R., Todaro, A., Alfonzo, A., Schicchi, R. et al. (2019). Insights Into the Cultivable Microbial Ecology of "Manna" Ash Products Extracted From Fraxinus angustifolia (Oleaceae) Trees in Sicily, Italy. *Frontiers in microbiology*, 10, 1-12.

Günbattı, C. (2004). Two Treaty Tablets Found at Kultepe. In: J. G. Derksen (ed.), *Assyria and Beyond: Studies Presented to Mogens Trolle Larsen*, Nederlands Instituut voor het Nabije Oosten, 249-68

Gürel, A., and Lermi, A. (2008). Pleistocene–Holocene fills of the Bor–Ereğli Plain (Central Anatolia): recent geo-archaeological contributions. In: L. d'Alfonso, M. E. Balza, and C. Mora (Eds), *Geo-archaeological Activities in Southern Cappadocia*, Italian University Press, 55–56.

Güterbock, H. G. (1972). Bemerkungen zu den Ausdrücken ellum, wardum und asirum in hethitischen Texten. In: D. O. Edzard (ed.), *Gesellschaftsklassen im Alten Zweistromland und in den angrenzenden Gebieten. XVIII. Rencontre assyriologique internationale, München, 29. Juni bis 3. Juli 1970*, Verlag der Bayerischen Akademie der Wissenschaften, 93-98.

Haase, R. (2003). The Hittite Kingdom. In: R. Westbrook (ed.), *A History of Ancient Near Eastern Law*, Brill, 619-56.

Haase, R. (2008). Fälle der Befreiung von den öffentlichen Dienstpflichten saḫḫanund luzzi nach der hethitischen Rechtssatzung. *Zeitschrift für Altorientalische und Biblische Rechtsgeschichte*, 14,

39-46.

Habiyaremye, C., Matanguihan, J. B., D'Alpoim Guedes, J., Ganjyal, G. M., Whiteman, M. R., Kidwell, K. K., and Murphy, K. M. (2017). Proso millet (Panicum miliaceum L.) and its potential for cultivation in the Pacific Northwest, US: a review. *Frontiers in plant science*, 7, 1961.

Hagenbuchner-Dresel, A. (2002). *Massangaben bei hethitischen Backwaren* (Dresdner Beiträge zur Hethitologie 1). Verlag der TU Dresden.

Halayqa, I. K. H. (2010). The demise of Ugarit in the light of its connections with Hatti. *Ugarit-Forschungen*, 42, 297-330.

Hald, M. M. (2010). Distribution of crops at late Early Bronze Age Titriş Höyük, southeast Anatolia: towards a model for the identification of consumers of centrally organised food distribution. *Vegetation History and Archaeobotany*, 19, 69-77.

Haldane, C. (1993). Direct evidence for organic cargoes in the Late Bronze Age. *World Archaeology*, 24: 348-360.

Haldon, J. (1990). *Byzantium in the Seventh Century: The Transformation of a Culture*. Cambridge University Press.

Hall, G., Woodborne, S. and Scholes, M. (2008). Stable carbon isotope ratios from archaeological charcoal as palaeoenvironmental indicators. *Chemical Geology*, 247, 384-400.

Halstead, P. (1990). Quantifying Sumerian agriculture - some seeds of doubt and hope. *Bulletin on*

Sumerian Agriculture, 5: 187-95.

Halstead, P., and Jones, G. (1989). Agrarian ecology in the Greek islands: time stress, scale and risk. *The Journal of Hellenic Studies*, 109, 41-55.

Hamilakis, Y. (1996). Wine, oil and the dialectics of power in Bronze Age Crete: a review of the evidence. *Oxford Journal of Archaeology*, 15(1), 1-32.

Hamilton, H. C., and Falconer, W. (1903). *The Geography of Strabo*. Bell & sons.

Hansen, J. M. (1988). Agriculture in the prehistoric Aegean: data versus speculation. *American Journal of Archaeology*, 92(1), 39-52.

Harlan, H. V., Bayles, B. B. and Johnson, A. G. (1937). Grains. In: H. H. van der Osten, *The Alishar Huyuk Seasons of 1930-32* (Oriental Institute Publications), University of Chicago Press, 333.

Harlan, J. R. (1968). On the origin of barley. *USDA Agriculture Handbook*, 338, 9-31.

Harmanşah, Ö. (2020). Cities, the underworld, and the infrastructure. The ecology of water in the Hittite world. In: M. S. Alt and T. R. Pauketat (ed.), *New Materialisms Ancient Urbanisms*, Routledge, 218-299.

Harmanşah, Ö., Johnson, P., Marsh, B. and Durusu-Tanriover, M. (2017). Lake-Places, Local Hydrology, and the Hittite Imperial Projects in the Ilgin Plain: Yalburt Yaylasi Archaeological Landscape Reserach Project 2015-2016 Seasons. In: S. R. Steadman and G. McMahon (eds), *The Archaeology of Anatolia Volume II Recent Discoveries (2015-2016)*, Cambridge Scholars Publishing, 302-320.

Harrison, L. K., Bilgen, A. N., and Kapuci, A. (2021). *The Early Bronze Age in Western Anatolia* (The Institute for European and Mediterranean Archaeology Distinguished Monograph Series). SUNY Press.

Harrison, R.M., Christie, N., et al. (1993). Excavations at Amorium: 1992 Interim Report. *Anatolian Studies*, 43, 147–162.

Harrison, T. (2010). The Late Bronze Age/Early Iron Age Transition in the Northern Orontes Valley. In: F. Venturi (ed), *Societies in Transition: Evolutionary Processes in the Northern Levant between Late Bronze Age II and Early Iron Age. Papers Presented on the Occasion of the 20th Anniversary of the New Excavations in Tell Afis, Bologna, 15th November 2007,* CLUEB, 83-102.

Hastorf, C. (2005). Macrobotanical Investigation: Field Methods and Laboratory Analysis Procedures. In: I. Hodder (ed), *Inhabiting Çatalhöyük: Reports from the 1995–99 Seasons*, British Institute at Ankara; McDonald Institute for Archaeological Research, 129-135.

Hastorf, C. A. and Popper, V. S. (1988). *Current Paleoethnobotany*. The University of Chicago Press.

Hastorf, C. A., and Foxhall, L. (2017). The social and political aspects of food surplus. *World Archaeology*, 49(1), 26-39.

Hawkins, J. D. (1988). Kuzi-Tešub and the "Great Kings" of Karkamiš. *Anatolian Studies,* 38, 99–108.

Hawkins, J. D. (1988). Kuzi-Tešub and the "Great Kings" of Karkamiš. *Anatolian Studies,* 38, 99-108.

Hawkins, J. D. (2000). *Inscriptions of the Iron Age. Vol. 1 of Corpus of Hieroglyphic Luwian Inscriptions*. De

Gruyter.

Hawkins, J. D., and Weeden, M. (2021). The New Inscription from Türkmenkarahöyük and its Historical Context. *Altorientalische Forschungen*, 48(2), 384-400.

Heer, O. (1866). Treatise on the plants of the Lake Dwellings, in F. Keller (ed), *The Lake Dwellings of Switzerland and other parts of Europe*, Longman's Green and Co, 518-536.

Heffron Y., Emre Şerifoğlu, T., Steele, C., and Stone, A. (2017). The J/K/L14 Soundings. In: J. N. Postgate (ed.), *Excavations at Kilise Tepe 2007–2011: The Late Bronze and Iron Ages*. https://tinyurl.com/kilisetepe (accessed September 15, 2018).

Heiss, A. G. (2016). Holz in Ephesos: Bauholz und Mobiliar in der spätantiken Residenz. *Gesellschaft Der Freunde Von Ephesos*, 1, 2–4.

Heiss, A. G. and Stika, H.P. (2013). Making the Incomparable Comparable? A New Attempt of the Semi-Quantitative Evaluation of Large-Scale Archaeobotanical Data. *Paper presented at the 16th Symposium of the International Work Group for Palaeoethnobotany*, Thessaloniki.

Heiss, A.G., and Thanheiser, U. (2016). Unters Mosaik geschaut – hellenistische und römerzeitliche Pflanzenreste. In: E. Rathmayr (ed), *Hanghaus 2 in Ephesos. Die Wohneinheit 7. Baubefund, Ausstattung, Funde*, Austrian Academy of Sciences Press, 625-641.

Heiss, A.G., and Thanheiser, U. (2020). Die Pflanzenreste. In: Ladstätter, S. (ed.), *Eine Frühkaiserzeitliche Grubenverfüllung Aus Dem Hanghaus 2 in Ephesos* (Jahreshefte Des Österreichischen Archäologischen Institutes in Wien), Holzhausen Verlag, 207-287.

Helbaek, H. (1961). Late Bronze Age and Byzantine Crops at Beycesultan in Anatolia. *Anatolian Studies*, 11, 77–97.

Helbaek, H. (1964). First Impressions of the Çatal Hüyük Plant Husbandry. *Anatolian Studies*, 14, 121–123.

Helbaek, H. (1970). The plant husbandry of Hacılar. A study of cultivation and domestication. In: J. Mellaart (ed), *Excavations at Hacılar*, Edinburgh University Press, 189-244.

Henry, A. (2011). *Paleoenvironnements et gestion du bois de feu au Mésolithique dans le sud-ouest de la France: anthracologie, ethno-archéologie et expérimentation*. Ph.D. Thesis, University of Nice-Sophia Antipolis.

Herveux, L. (2007). La crise de 2100 av. J.-C. a-t-elle eu lieu ? Indices archéobotaniques au Levant nord. In: C. Kuzucuoğlu and C. Marro (eds), *Sociétés humaines et changement climatique à la fin du troisième millénaire: une crise a-t-elle eu lieu en Haute Mésopotamie? Actes du Colloque de Lyon (5-8 décembre 2005)*, 549-555. Varia Anatolica. Institut Français d'Études Anatoliennes-Georges Dumézil.

Highcock, N. A., Yolacan, B., and D'Alfonso, L. (2020). Archaeoligical Excavations at Nigde-Kinik-Höyük. Campaigns 2018-2019. *Athenaeum*, (2), 568-580.

Highcock, N., and Matessi, A. (2021) The Early Bronze Age at Kınık Höyük (Niğde). In: Kulakoğlu F, Michel C, Kryszat G (Eds), *Proceedings of the 4th Kültepe International Meeting* (Subartu, 46), Brepols, 275-292.

Highcock, N., Crabtree, P., Campana, D. V., Capardoni, M., Lanaro, A., Matessi, A., Miller, N. F., Strosahal, Trameri, A., and D'Alfonso, L. (2015). Kınık Höyük, Niğde. A New Archaeological Project in Southern Cappadocia. In: R. Steadman, and G. McMahon (eds), *The Archaeology of Anatolia: Recent Discoveries (2011-2014)*, Cambridge Scholars Publishing, 97-127.

Highcock, N., Yolaçan, B., Castellano, L., Casagrande-Kim, R., Dalkiliç, E., Derada, M., Lovejoy, N., Mantovan, A., Stroshal, P., Trameri, A., and d'Alfonso, L. (forthcoming). Archaeological Excavations at Kınık Höyük: Excavation Report 2019. *Kazı Sonuçları Toplantısı.*

Hillman, G. (1973). Agricultural productivity and past population potential at Aşvan. *Anatolian Studies*, 23, 225-240.

Hillman, G. (1978). On the Origins of Domestic Rye (Secale Cereale): the Finds from Aceramic Can Hasan III in Turkey. *Anatolian Studies*, 28, 157–174.

Hillman, G. (1981). Reconstructing crop husbandry practices from the charred remains of crops. In: R. J. Mercer (ed), *Farming Practice in British Prehistory*, Edinburgh University Press, 123-162.

Hillman, G. (1984a). Interpretation of archaeological plant remains: the application of ethnographic models from Turkey. In: W. van Zeist and W. A. Casparie (eds), *Plants and Ancient Man; Studies in Palaeoethnobotany*, Balkema, 1-41.

Hillman, G. (1984b). Traditional Husbandry and processing of archaic cereals in recent times: the operations, products and equipment which might feature in Sumerian texts. Part I: the glume wheats. *Bulletin on Sumerian Agriculture*, 1: 114-152.

Hillman, G. (1985). Traditional Husbandry and processing of archaic cereals in recent times: the operations, products and equipment which might feature in Sumerian texts. Part II: the free-threshing cereals. *Bulletin on Sumerian Agriculture*, 2: 1-31.

Hodder, I. (2015). James Mellaart, 1925–2012. *Biographical Memoirs of Fellows of the British Academy*, XIV, 411-420.

Hoffman, I. (1984). *Der Erlass Telipinus* (Texte der Hethiter 11). Carl Winter.

Hoffner, H. A. (1974). *Alimenta Hethaeorum* (American Oriental Series 55). American Oriental Society.

Hoffner, H. A. (1997). *The Laws of the Hittites: A Critical Edition*. Brill.

Hoffner, H. A. (2001). Alimenta revisited. In: W. Gernot (ed.), *Akten des IV Internationalen Kongresser fur Hethitologie Vurtzburg,4-8 Oktober 1999* (Studien zu den Bogazakoy Texte 45), Harrassowitz Verlag, 199-212.

Hoffner, H. A. (2009). *Letters from the Hittite Kingdom* (Writings from the Ancient World 15). SBL press.

Højte, J. M. (2009). *Mithridates Vi And The Pontic Kingdom*. Aarhus University Press.

Holloway, R. G. and Bryant, V. M. (1986) New directions of palynology in ethnobiology. *Journal of Ethnobiology*, 6(1), 47–65.

Hopf, M. (1992). Plant remains from Boğazköy, Turkey. *Review of Palaeobotany and Palynology,* 73, 99–104.

Horejs, B., Galik, A., and Thanheiser, A. (2008). Erster Grabungsbericht zu den Kampagnen 2006 und

2007 am Çukuriçi Höyük bei Ephesos. *Jahreshefte des Österreichischen Archäologischen Institutes in Wien*, 77, 91–106.

Horejs, B., Galik, A., Thanheiser, A., and Wiesinger, A. (2011). Aktivitäten und Subsistenz in den Siedlungen des Çukuriçi Höyük. Der Forschungsstand nach den Ausgrabungen 2006–2009. *Prähistorische Zeitschrift*, 86, 31–66.

Hovsepyan, R., and Willcox, G. (2008). The earliest finds of cultivated plants in Armenia: evidence from charred remains and crop processing residues in pisé from the Neolithic settlements of Aratashen and Aknashen. *Vegetation history and archaeobotany*, 17(1), 63-71.

Hroudová, Z., Zákravský, P., Ducháček, M., and Marhold, K. (2007). Taxonomy, distribution and ecology of Bolboschoenus in Europe. *Annales Botanici Fennici*, 44(2), 81–102

Hudson, M., and Wunsch, C. (2004). *Creating Economic Order. Record-Keeping, Standardization and the Development of Accounting in the Ancient Near East.* Capital Decisions Ltd.

Hunt, H. V., Vander Linden, M., Liu, X., Motuzaite-Matuzeviciute, G., Colledge, S., and Jones, M. K. (2008). Millets across Eurasia: chronology and context of early records of the genera Panicum and Setaria from archaeological sites in the Old World. *Vegetation History and Archaeobotany*, 17(1), 5-18.

Huot, J.-L. (1991). *Oueili, travaux de 1985* (Memoire 89). Editions Recherche sur les Civilisations.

Hüser, A. (2006). Wasser für Sarissa: Mit großem technischen Wissen errichteten hethitische Ingenieure im2. Jt. v. Chr. Bauten zur Wasserversorgung. *Antike Welt*, 37(5), 93-97.

Hüser, A. (2007). *Hethitische Anlagen zur Wasserversogung und Entsorgung* (Kusakli-Sarissa 3). VML Verlag.

ICARDA (2003). *ICARDA Annual Report 2002*. International Center for Agricultural Research in the Dry Areas, Aleppo (Syria).

Imparati, F. (2004). Aspects de l'organisation de l'état hittite dans les documents juridiques et administratifs. *Journal of the Economic and Social History of the Orient*, 25(3), 225-267.

İnal, O. (2021). One-Humped History: The Camel as Historical Actor in the Late Ottoman Empire. *International Journal of Middle East Studies*, 53(1), 57-72.

İnceoğlu Ö. Pehlivanlı S. (1987). İç Andolu bölgesindeki Tuzgölü Kuvaterner tabakalarında palinolojik bir araştırma. *Doğa Türk Botonik Derg.,* II(1), 58-86.

Iren, I. (2010). New Discovery in Dascylium: the Persian Destruction Layer. In: P. Matthiae, F. Pinnock, L. Nigro, N. Marchetti, L. Romano (eds), *Proceedings of the 6th International Congress on the Archaeology of the Ancient Near East*, Vol. 2, Wiesbaden, 249-263.

Izdebski, A. (2013). *Rural economy in transition: Asia Minor from Late Antiquity into the early middle ages* (The Journal of Juristic Papyrology Supplements 18). University of Warsaw, Faculty of Law and Administration.

Jacobsson, P., Hamilton, W. D., Cook, G., Crone, A., Dunbar, E., Kinch, H., et al. (2018). Refining the Hallstatt plateau: short-term 14C variability and small scale offsets in 50 consecutive single tree-rings from southwest Scotland dendro-dated to 510–460 BC. *Radiocarbon,* 60(1), 219-237.

Jacomet, S. (2006). *Identification of cereal remains from archaeological sites*. IPAS, Basel University.

Jacomet, S. (2013). Archaeobotany: analyses of plant remains from waterlogged archaeological sites. In: F. Menotti and A. O'Sullivan (eds), Wetland Archaeology, Oxford University Press, 497-514.

Jacquat, C., and Martinoli, D. (1999). Vitis vinifera L.: wild or cultivated? Study of the grape pips found at Petra, Jordan; 150 BC–AD 40. *Vegetation History and Archaeobotany*, 8(1), 25-30.

Jansonius, J., and McGregor, D. C. (1996). *Palynology: Principles and Applications*. American Association of Stratigraphic Palynologists Foundation.

Jones, G. (1981). Crop processing at Assiros Toumba: a taphonomic study. *Zeitschrift fur Archaologie* 15, 105-111

Jones, G. (1983). *The Use of Ethnographic and Ecological Models in the Interpretation of Archaeological Plant Remains: Case Studies from Greece*. Unpublished Ph.D. dissertation, University of Cambridge.

Jones, G. (1984). Interpretation of archaeological plant remains: ethnographic models from Greece. In: W. van Zeist and W. A. Casparie (eds), *Plants and Ancient Man: Studies in Paleoethnobotany*, Balkema, 43-61.

Jones, G. (1987). A Statistical Approach to the Archaeological Identification of Crop Processing. *Journal of Archaeological Science*, 14, 311-323.

Jones, G. (1990). The application of present-day cereal processing studies to charred archaeobotanical remains. *Circaea*, 6(2), 91-96.

Jones, G., and Halstead, P. (1995). Maslins, mixtures and monocrops: On the interpretation ofarchaeobotanical crop samples of heterogeneous composition. *Journal of Archaeological Science*, 22(1), 103-114.

Jones, G., and Valamoti, S. M. (2005). Lallemantia, an imported or introduced oil plant in Bronze Age northern Greece. *Vegetation history and archaeobotany*, 14(4), 571-577.

Jones, H. L. (1917). *The geography of Strabo* (The Loeb Classical Library). Harvard University Press

Jones, M. (1988). The arable field: a botanical battleground. In: M. Jones (ed), *Archaeology and the Flora of the British Isles: Human Influence on the Evolution of Plant Communities*, Oxford University Committee for Archaeology, 86–92.

Juráček, M., Vašeková, P., Massányi, P., Kováčik, A., Bíro, D., Šimko, M., et al. (2021). The Effect of Dried Grape Pomace Feeding on Nutrients Digestibility and Serum Biochemical Profile of Wethers. *Agriculture*, 11(12), 1194.

Kabukcu, C. (2017). Woodland vegetation history and human impacts in south-central Anatolia 16,000–6500 cal BP: Anthracological results from five prehistoric sites in the Konya plain. *Quaternary Science Reviews*, 176, 85–100.

Kabukcu, C. (2018a). Wood Charcoal Analysis in Archaeology. In: E. Pişkin, A. Marciniak and M. Bartkowiak (eds), *Environmental Archaeology. Interdisciplinary Contributions to Archaeology*, Springer, 133-154.

Kabukcu, C. (2018b). Identification of woodland management practices and tree growth conditions in archaeological fuel waste remains: A case study from the site of Çatalhoyük in central Anatolia, Turkey. *Quaternary International*, 463, 282-297.

Kabukcu, C. and Chabal, L. (2021). Sampling and quantitative analysis methods in anthracology from archaeological contexts: Achievements and prospects. *Quaternary International*, 593/594, 6-18.

Kabukcu, C., Asouti, E., Pöllath, N., Peters, J., and Karul N. (2021). Pathways to plant domestication in Southeast Anatolia based on new data from aceramic Neolithic Gusir Höyük. *Scientific Reports*, 11, 2112.

Kamar, G. (2018). Palynology of Lake Arin (Eastern Anatolia, Turkey) deposits and its relation with water level change of Lake Van: Preliminary findings. *Quaternary International*, 486, 83-88.

Kaniewski, D., De Laet, V., Paulissen, E., and Waelkens, M. (2007). Long-term effects of human impact on mountainous ecosystems, western Taurus Mountains, Turkey. *Journal of Biogeography*, 34(11), 1975-1997.

Kaniewski, D., Paulissen, E., De Laet, V., Dossche, K., and Waelkens, M. (2007). A high-resolution Late Holocene landscape ecological history inferred from an intramontane basin in the Western Taurus Mountains, Turkey. *Quaternary Science Reviews*, 26(17-18), 2201-2218.

Kaniewski, D., Paulissen, E., Van Campo, E., Bakker, J., Van Lerberghe, K., and Waelkens, M. (2009). Wild or cultivated Olea europaea L. in the eastern Mediterranean during the middle—late Holocene? A pollen-numerical approach. *The Holocene*, 19(7), 1039-1047.

Kansa, S.W., Kennedy, A., Campbell, S., and Carter, E. (2009). Resource Exploitation at Late Neolithic Domuztepe: Faunal and Botanical Evidence. *Current Anthropology*, 50, 897–914.

Kaptan, D. (2002). *Daskyleion Bullae Seal Images From the Western Achaemenid Empire*. Nederlands Instituut voor het Nabije Oosten.

Karagöz, Ş. (2005). A Graeco-Persian Monument of Anatolian Type: The Bünyan Altar. *Anadolu Araştırmaları*, XVIII(2), 137-152.

Karakaya, D. (2019). *Botanical Aspects of the Environment and Economy at Tell Tayinat from the Bronze to Iron Ages (ca. 2.200 – 600 BCE), in south-central Turkey* (PhD dissertation). University of Tübingen.

Karami, H., Rezaei, M., Sarkhosh, A., Rahemi, M., and Jafari, M. (2018). Cold hardiness assessment in seven commercial fig cultivars (Ficus carica L.). *Gesunde Pflanzen*, 70(4), 195-203.

Kashima, K. (2002). Environmental and climatic changes during the last 20,000 years at Lake Tuz, central Turkey. *Catena*, 48(1-2), 3-20.

Kavak, S., Çakan, H., and Genç, E. (2018). Doğanpınar Barajı Tilbaşar Höyük (Gaziantep) kazıları Ortaçağ mezarlarında kullanılan ahşapların arkeobotaniksel değerlendirilmesi. *Arkeometri Sonuçları Toplantısı,* 33, 211–220.

Kavak, S., Çakan, H., and Girginer, K. S. (2017). Tatarlı Höyük arkeobotanik çalışmalarında elde edilen büyülü bitki: Mandragora (GIS NAM.TAR). *Arkeometri Sonuçları Toplantısı,* 32, 195–203.-

Kavak, S., Çakan, H., and Girginer, K. S. (2019a). Tatarlı Höyük (Ceyhan/Adana) 2017 kazı sezonu arkeobotanik sonuçları ve değerlendirilmesi. *Arkeometri Sonuçları Toplantısı*, 34, 475–485.

Kavak, S., Çakan, H., and Türkcan, A. U. (2019b). Kanlitaş Höyük (Eskişehir) 2017 kazi sezonu arkeobotanik sonuçlari ve değerlendirilmesi. *Arkeometri Sonuçları Toplantısı*, 34, 497–508.

Kavak, S., Çakan, H., Türkcan, A. U., and Balcı, H. (2018). Kanlitaş Höyük (Eskişehir) 2016 kazi sezonu arkeobotanik sonuçlari. *Arkeometri Sonuçları Toplantısı*, 33, 223–232.

Kavak, S., Girginer, K. S., and Çakan, H. (2014). Tatarlı Höyük M.Ö II. Binyıl tabakalarına ait arkeobotaniksel bulgular: on rapor. *Arkeometri Sonuçları Toplantısı*, 29, 115–120.

Kaya, A., and Dirmenci, T. (2012). Nutlet morphology of Turkish Ziziphora L.(Lamiaceae). *Plant Biosystems-An International Journal Dealing with all Aspects of Plant Biology*, 146(3), 560-563.

Kayacik, H., and Aytuğ, B. (1968). Gordion kral mezarı'nın ağaÇ malzemesi üzerinde ormancılık yönünden araştırmalar. *İstanbul Üniversitesi Orman Fakültesi Dergisi,* 18, 37–54.

Kazancı, N. and Roberts, N. (2019). The Lake Basins of South-west Anatolia. In: C. Kuzucuoğlu, A., Çiner and N. Kazancı (eds), *Landscapes and Landforms of Turkey*, Springer, 325-337.

Kealhofer, L. and Grave, P. (2011). The Iron Age on the Central Anatolian Plateau. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia:* (*10,000-323 BCE*), Oxford University Press.

Kealhofer, L., Grave, P., and Voigt, M. (2019). Dating Gordion: The Timing and Tempo of Late Bronze and Early Iron Age Political Transformation. *Radiocarbon*, 61(2), 495-514.

Keepax, C.A. (1988). *Charcoal Analysis with Particular Reference to Archaeological Sites in Britain*. Ph.D. Thesis. University of London.

Keller, F. (1866). *The Lake Dwellings of Switzerland and other parts of Europe*. Longman's Green and Co.

Kenar, N. (2014). Notes and contributions on the flora of Melendiz Mountains and its surroundings (Niğde, Turkey). *Flora Mediterranea,* 24, 109–138.

Kenar, N., Katenoğlu, H. (2016). The phytosociology of Melendiz Mountain in the Cappadocian part of Central Anatolia (Niğde, Turkey). *Phytocoenologia*, 46(2), 141–183.

Kennedy, A. (2000). Ottoman Plant Remains from Kaman-Kalehöyük. *Anatolian Archaeological Studies,* 9, 147-165.

Kepinski-Lecomte, C., Bulgan, F., Gailhard, N., Herveux, L., and Perello, B. (2006). Travaux menés à Tilbeshar en 2005 (Sud-Est anatolien). *Anatolia Antiqua*, 14, 251–259.

Kilic, N. K., and Ersin, S. (2019). Determination of Late Holocene vegetation of Lake Aktas and its surrounding area by palynological analysis. *Comptes Rendus de L'Academie Bulgare Des Sciences*, 72(1), 100–106.

Kılıç, N. K., Caner, H., Erginal, A. E., Ersin, S., Selim, H. H., and Kaya, H. (2018). Environmental changes based on multi-proxy analysis of core sediments in Lake Aktaş, Turkey: Preliminary results. *Quaternary International*, 486, 89-97.

Kitchen, K. A. (1982). *Ramesside Inscriptions: Historical and Biographical. Vol. 4*. Blackwell.

Kleber, K. (2015). Taxation in the Achaemenid Empire. In: *Oxford Handbooks Online. Classical Studies*. Oxford University Press.

Klengel, H. (1974). “Hungerjahre” in Hatti. *Altorientalische Forschungen*, 1: 165-74.

Klengel, H. (1986). The Economy of the Hittite Household (É). *Oikumene*, 5, 23-31,

Klengel, H. (2006). Studien zur hethitischen Wirtschaft, 2: Feld-und Gartenbau. *Altorientalische Forschungen*, 33(1), 3-21.

Klengel, H., Imparati, F., Hass, V. and van Den Hout T. P. J. (1999). *Geschichte des hethitischen Reiches*. Brill.

Klingel, J. (2022). Hittite Economics. In S. de Martino (ed), *Handbook Hittite Empire. Power Structure*s, De Gruyter, 605-648.

Kloekhorst, A. (2008). *Etymological Dictionary of the Hittite Inherited Lexicon* (Leiden Indo-European Etymological Dictionary Series, Volume 5). Brill.

Knapp, A. B. (1993). Thalassocracies in Bronze Age eastern Mediterranean trade: making and breaking a myth. *World Archaeology*, 24(3), 332-347.

Knapp, A. B., and Manning, S. W. (2016). Crisis in Context: The End of the Late Bronze Age in the Eastern Mediterranean. *American Journal of Archaeology*, 120 (1), 99-149.

Knipping, M., Müllenhoff, M., and Brückner, H. (2008). Human induced landscape changes around Bafa Gölü (western Turkey). *Vegetation History and Archaeobotany*, 17(4), 365-380.

Konyar, E. (2006). Old Hittite Presence in the East of the Euphrates in the Light of the Stratigraphical Data from İmikuşağı (Elazığ), in D. P Mielke, U. D. Schoop, J. Seeher (eds), *Structuring and Dating in Hittite Archaeology* (BYZAS 4), Ege Yayınları, 333-348.

Korbel, G. (1985). *Die spätbronzezeitliche Keramik van Norşuntepe* (Institut für Bauen und Planen in Entwicklungslädern Mitteilungen 4). Hannover.

Körber-Grohne, U., and Piening, U. (1980). Microstructure of the surfaces of carbonized and non-carbonized grains of cereals as observed in scanning electron and light microscopes as an additional aid in determining prehistoric findings. *Flora*, 170(3), 189-228.

Korfmann, M. (1983). *Demircihuyuk 1, Architektur, Stratigraphie und Befunde*. Von Zabern.

Körte, A. and Körte, G. (1904). *Gordion: Ergebnisse der Ausgrabung im Jahre 1900*. Georg Reimer.

Kroll, H. (1991). Südosteuropa. In: W. van Zeist, K. Wasylikowa, and K.-E. Behre (eds), *Progress in Old World Palaeoethnobotany*, A. A. Balkema, 161–77.

Kroll, H. (1999). Vor- und frühgeschichtliche Weinreben – wild oder angebaut? Eine abschließende Bemerkung, *Trierer Zeitschrift*, 62, 151–153.

Krsmanovic, D. (2017). *Political Authority and Storage in Early-Middle Iron Age (1200–800 BCE) Central Anatolia* (PhD dissertation). University of Leicester

Kučan, D. (2000). Rapport synthétique sur les recherches archéobotaniques dans le sanctuaire d'Héra de l'île de Samos. In: J.-M. Luce (ed.), *Paysage et alimentation dans le monde grec, Les innovations du premier millénaire av. J.C.* (Pallas revue d’etudes antiques 52), Presses Universitaires du Mirail,99–108

Kuhn, S. L., Dinçer, B., Balkan-Atlı, N., & Erturaç, M. K. (2015). Paleolithic occupations of the Göllü Dağ, Central Anatolia, Turkey. *Journal of Field Archaeology*, 40(5), 581-602.

Kühne, H. (2018). *Water for Assyria*. Harrassowitz Verlag.

Kulakoğlu, F. (2011). Kültepe-Kaneš: a second millennium BCE trading center on the central plateau. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia:* (*10,000-323 BCE*), Oxford University Press.

Kulakoğlu, F. (2017). Early Bronze Age monumental structures at Kültepe. In: F. Kulakoğlu and G. Barjamovic (eds), *Proceedings of the 2nd Kültepe International Meeting* (Subartu 39), Brepols, 217-226.

Kulakoğlu, F., Emre, K., Kontani, R., Ezer, S., and Öztürk, G. (2013). Kültepe-Kaniş, Turkey: Preliminary Report on the 2012 Excavations. *Bulletin of the Okayama Orient Museum,* 27, 43–50.

Kuniholm, P. I., Tarter, S. L. Newton, M. W. and Griggs, C. B. (1992). Dendrochronological investigations at Porsuk/Ulukisla, Turkey. Preliminary report, 1987-1989. Syria. Archéologie, Art et histoire , 69 3-4 pp. 379-389

Kunth, C. (1826). Examen Botanique. In: J. Passalaqua (ed), *Catalogue Raisonne et Historique de*

Antiquités Découverte en Egypte, Musées Nationaux, 227-28.

Kürschner, H. (1984). *Der östliche Orta Toroslar* (*Mittlerer Taurus*) *und angrenzende Gebiete. Eine formationskundliche Darstellung der Vegetation Südost-Anatoliens*. (Tübinger Atlas Vorderer Orient 15). Ludwig Reichert

Kurt L., Tug G. N. and Ketenoglu O. (2006). Synoptic View of the Steppe Vegetation of Central Anatolia (Turkey). *Asian Journal of Plant Sciences*, 5: 733-739.

Kutlu, L., Özdoğan, A. E., and Çakır, E. A. (2018). Archaeobotanical Studies at Sumaki Höyük (Batman, Turkey) in 2014. *Eurasian Journal of Forest Science*, 6, 26–34.

Kuzucuoğlu, C. (2012). Dimensions territoriales des changements climatiques et des grandes ruptures culturelles de l'Age du Bronze en Méditerranée orientale et au Proche-Orient. In: P. Beckouche, C. Grasland, F. Guérin-Pace, and J.-Y. Moisseron (Eds), *Actes du colloque fondateur du CIST - Fonder les sciences du territoire*, 159-169.

Kuzucuoğlu, C. (2015). The Rise and Fall of the Hittite State in Central Anatolia: How, When, Where, Did Climate Intervene? In: D. Beyer, O. Henry, and A. Tibet (ed.), *La Cappadoce méridionale: de la préhistoire à la période byzantine*, Ege Yayinlari, 17-41.

Kuzucuoğlu, C. (2019). Geology and geomorphology of the Cappadocia volcanic Province, Turkey. *Mediterranean Geoscience Reviews*, 1(2), 163-166.

Kuzucuoğlu, C., Bertaux, J., Black, S., Denefle, M., Fontugne, M., Karabiyikoğlu, M., Kashima, K., Limondin-Lozouet, N., Mouralis, D., and Orth, P. (1999). Reconstruction of climatic changes during the Late Pleistocene, based on sediment records from the Konya Basin (Central Anatolia, Turkey). *Geological Journal*, 34, 175-198.

Kuzucuoğlu, C., Çiner, A., Kazancı, N., (2019). The Geomorphological Regions of Turkey. In: C. Kuzucuoğlu, A., Çiner and N. Kazancı (eds), *Landscapes and Landforms of Turkey*, Springer, 41-178.

Kuzucuoğlu, C., Dörfler, W., Kunesch, S., and Goupille, F. (2011). Mid-to late-Holocene climate change in central Turkey: The Tecer Lake record. *The Holocene*, 21(1), 173-188.

Kuzucuoğlu, C., Gürel, A., Demir, M., Çakıcı, S., and Dumoulin, J-P. (Forthcoming). Hydrogeomorphological records of climate changes during the Bronze and Iron Ages in the Bor Plain (Central Anatolia). In: L. d'Alfonso, I. Calini, R. Hawley and M.G. Masetti-Rouault (Eds), *Between the Age of Diplomacy and the First Great Empire in Ancient West Asia (1200-900 BC): Moving Beyond the Paradigm of Collapse and Regeneration*, NYU Press.

Kuzucuoğlu, C., Karabiyikoğlu, M., Fontugne, M., Pastre, J. F., and Ercan, T. (1997). Environmental changes in Holocene lacustrine sequences from Karapinar in the Konya Plain (Turkey). In: N. Dalfes, G. Kukla, and H. Weiss (Eds), *Third Millennium BC Climate Change and Old World Collapse* (NATO ASI Series 49), Springer, 451-463.

Kuzucuoğlu, C., Parish, R., and Karabıyıkoğlu, M. (2018). The Dune Systems of the Konya Plain (Turkey). Their Relation to the Environmental Changes in Central Anatolia During the Late Pleistocene and Holocene. *Geomorphology*, 23, 257-271

Kuzuoğlu, R. (2016). Two Cuneiform Texts Found in Acemhöyük from the Old Assyrian Period. *Belleten Türk Tarih Kurumu*, LXXX (289), 685-699.

Lackenbacher, S., and Malbran-Labat, F. (2016). *Lettres en akkadien de la Maison d'Urtenu: fouilles de 1994* (Ras Shamra-Ougarit 23). Peeters.

Lanaro, A., Castellano, L., Highcock, N., Mantovan, A., and d'Alfonso, L. (2020). South-Central Anatolia during the Iron Ages: a diachronic view from Kınık Höyük (Niğde). In: A. Otto, M. Herles, K. Kaniuth, L. Korn, A. Heidenreich (Eds), *Proceedings of the 11th ICAANE*. Harrassowitz-Verlag, 215-228.

Laneri, N. (2018). The Impact of Wine Production in the Social Transformation of Northern Mesopotamian Societies during the Third and Second Millennia BCE. *Die Welt des Orients*, 48(2), 225-236.

Laneri, N. (2016). *Hirbemerdon Tepe Archaeological Project 2003–2013 Final Report: Chronology and Material Culture*. BraDypUS.

Laneri, N., Schwartz, M., Ur, J., Valentini, S., d'Agostino, A., Berthon, R., and Halde, M. M. (2008). The Hirbemerdon Tepe Archaeological Project 2006-2007. *Anatolica*, 34, 177–239.

Laneri, N., Schwartz, M., Ur, J., Valentini, S., d'Agostino, A., Berthon, R., and Halde, M. M. (2015). Ritual and Identity in Rural Mesopotamia: Hirbemerdon Tepe and the Upper Tigris River Valley in the Middle Bronze Age. *American Journal of Archaeology*, 119, 533–564.

Langer, C. (2021). *Egyptian Deportations of the Late Bronze Age. In Egyptian Deportations of the Late*

Bronze Age. De Gruyter.

Langgut, D., Cheddadi, R., Carrión, J. S., Cavanagh, M., Colombaroli, D., Eastwood, W. J., et al. (2019). The origin and spread of olive cultivation in the Mediterranean Basin: The fossil pollen evidence. *The Holocene*, 29(5), 902-922.

Laroche, E. (1971). *Catalogue des Textes Hittites* (Etudes et commentaires 75). Klincksieck.

Larsen, M. T. (2015). *Ancient Kanesh. A Merchant Colony in Bronze Age Anatolia.* Cambridge University Press.

Latorre, S. M., Lang, P. L. M., Burbano, H. A. and Gutaker, R. M. (2020). Isolation, library preparation, and bioinformatic analysis of historical and ancient plant DNA. *Current Protocols in Plant Biology*, 5, e20121.

Legendre, P., and Birks, H. J. B. (2012). From classical to canonical ordination. In: H. J. B. Birks, A. F. Lotter, S. Juggins, J. P. Smol JP (eds.), *Tracking Environmental Change Using Lake Sediments. Volume 5: Data Handling and Numerical Techniques*, Springer, 201-248.

Legendre, P., Gallagher, E. D. (2001). Ecologically meaningful transformations for ordination of species data. *Oecologia*, 129, 271–280

Leney, L. and Casteel, R.W. (1975). Simplified procedure for examining charcoal specimens for identification.*Journal of Archaeological Sciences*, 2, 153-159.

Leroy, S. A., Boyraz, S., and Gürbüz, A. (2009). High-resolution palynological analysis in Lake Sapanca as a tool to detect recent earthquakes on the North Anatolian Fault. *Quaternary Science Reviews*, 28(25-26), 2616-2632.

Leroy, S., Kazancı, N., İleri, Ö., Kibar, M., Emre, O., McGee, E., and Griffiths, H. I. (2002). Abrupt environmental changes within a late Holocene lacustrine sequence south of the Marmara Sea (Lake Manyas, NW Turkey): possible links with seismic events. *Marine Geology*, 190(1-2), 531-552.

Levadoux, L. (1956). Les populations sauvages et cultivées des Vitis vinifera L. *Annales de L'amélioration Des Plantes*, 59-118.

Lewy, H. (1956). On some Old Assyrian cereal names. *Journal of the American Oriental Society*, 76(4), 201-204.

Lightfoot, C. S., Ivison, E. A., et al. (1995). Amorium Excavations 1994: the Seventh Preliminary Report. *Anatolian Studies*, 45, 105–138.

Limier, B., Ivorra, S., Bouby, L., Figueiral, I., Chabal, L., Cabanis, M., Ater, M., Lacombe, T., Ros, J., Brémond, L., and Terral, J.F. (2018). Documenting the history of the grapevine and viticulture: A quantitative eco-anatomical perspective applied to modern and archaeological charcoal. *Journal of archaeological science*, 100, 45-61.

Lindau, G. (1922). Fossile Samen von Troja. *Prähistorische Zeitschrift*, 13/14, 172-176.

Lindsay, H. (2005). Amasya and Strabo's patria in Pontus. In: D. Dueck, H. Lindsay, and S. Pothecary (eds), *Strabo's Cultural Geography: The Making of a Kolossourgia*, Cambridge University Press,

180-199.

Liphshitz, N., and Bigger, G. (1991). Cedar of Lebanon ("Cedrus libani") in Israel during Antiquity. *Israel Exploration Journal*, 41(1/3), 167-175.

Lister, D. L., and Jones, M. K. (2013). Is naked barley an eastern or a western crop? The combined evidence of archaeobotany and genetics. *Vegetation History and Archaeobotany*, 22(5), 439-446.

Lister, D. L., Jones, H., Oliveira, H. R., Petrie, C. A., Liu, X., Cockram, et al. (2018). Barley heads east: Genetic analyses reveal routes of spread through diverse Eurasian landscapes. *PloS one*, 13(7), e0196652.

Litt, T., Pickarski, N., Heumann, G., Stockhecke, M., and Tzedakis, P. C. (2014). A 600,000 year long continental pollen record from Lake Van, eastern Anatolia (Turkey). *Quaternary Science Reviews*, 104, 30-41.

Livarda, A. (2008). New temptations? Olive, cherry and mulberry in Roman and Medieval Europe. In: S. Baker, M. Allen, S. Middle, K. Poole (eds), *Food and Drinks in Archaeology 1*. Prospect Books, 73-83.

Liverani, M. (2011). *International Relations in the Ancient Near East* (Studies in Diplomacy and International Relations). Palgrave Macmillan.

Liverani, M. (2012). Melid in the Early and Middle Iron Age: Archaeology and History. In: G. Galil, A. Gilboa, A. M. Maeir, and D. Kahn (eds), *The Ancient Near East in the 12th–10th Centuries BCE: Culture and History. Proceedings of the International Conference Held at the University of Haifa,* *2–5 May, 2010* (Alter Orient und Altes Testament 392), Ugarit-Verlag, 327-44.

Liverani, M. (2014). *The Ancient Near East: History, Society and Economy*. Routledge.

Llyod, S. (1965). *Beycesultan. Vol. III, Part I, Late Bronze Age Architecture* (Occasional Publications of the British Institute of Archaeology at Ankara 11). The British Institute of Archaeology at Ankara.

Logothetis, B. (1970). The development of the vine and of viticulture in Greece based on archaeological findings in the area (in Greek with English summary). *Epistimoniki Epetiris tis Geoponikis kai Dasologikis Sholis, University of Thessaloniki,* 13, 167-249.

Logothetis, B. (1974). The contribution of the vine and the wine to the civilization of Greece and Eastern Mediterranean (in Greek with French summary). *Epistimoniki Epetiris tis Geoponikis kai Dasologikis Sholis, University of Thessaloniki*, 17, 5-286.

Longford, C. (2015). *Plant Economy of the Kura-Araxes. A comparative analysis of agriculture in the Near East from the Chalcolithic to the Middle Bronze Age* (PhD Dissertation). University of Sheffield

Longford, C., and Sagona, A. (2021). The Kura-Araxes economy: mobile pastoralism or sedentary agriculture? Perspectives from Sos Höyük. In: C. Marro and T. Stöllner (eds), *On Salt, Copper, and Gold, the origins of early mining and metallurgy in the Caucasus,* Mom Editions, 347-374.

Longford, C., Drinnan, A., and Sagona, A. (2009). Archaeobotany of Sos Höyük, northeast Turkey. In: A. Fairbairn, S. O'Connor, and B. Marwick (eds), *New Directions in Archaeological Science,* ANU Press, 121-136.

Lonie, I. M. (2011). *The Hippocratic Treatises" On Generation", On the Nature of the Child," Diseases IV"* (Ars Medica/Abteilung 2, Griechisch-lateinische Medizin). De Gruyter.

Luckenbill, D. D. (1927). *Ancient Records of Assyria and Babylonia Volume 2: Historical Records of Assyria From Sargon to the End.* University of Chicago Press.

Macchioni, N., and Lazzeri, S. (2013). Tilmen Höyük: Identification of Wood Species from Areas E and G. *Gaziantep Regional Project Occasional Paper*, 4, 1–3.

Maekawa, K. (1985). Cereal cultivation in the Ur III period. *Bulletin on Sumerian Agriculture*, 1: 73-96.

Mangafa, M., and Kotsakis, K. (1996). A new method for the identification of wild and cultivated charred grape seeds. *Journal of archaeological science*, 23(3), 409-418.

Manning, S. W., Griggs, C. B., Lorentzen, B., Barjamovic, G., Ramsey, C.B., Kromer, B., et al. (2016). Integrated Tree-Ring-Radiocarbon High-Resolution Timeframe to Resolve Earlier Second Millennium BCE Mesopotamian Chronology. *PLoS ONE*, 11(7), e0157144

Manning, S. W., Höflmayer, F., Moeller, N., Dee, M. W., Ramsey, C. B., Fleitmann, et al. (2014). Dating the Thera (Santorini) eruption: archaeological and scientific evidence supporting a high chronology. *Antiquity*, 88(342), 1164-1179.

Manuelli, F. (2012). A View from the East: Arslantepe and the Central Anatolian World during the Late Bronze and Iron Ages. Interactions and Local Development. *Origini* 34:361–74.

Manuelli, F. (2013). *Arslantepe-Late Bronze Age: Hittite Influence and Local Tradition in an Eastern*

Anatolian Community. Sapienza Università di Roma, Dipartimento di scienze dell'antichità.

Manuelli, F. (2020). The Regeneration of the Late Bronze Age Traditions and the Formation of the Kingdom of Malizi. In: A. Sonne and V. van Exel (eds), *Formation, Organization and Development of the Iron Age Societies*, Harrassowitz, 109-130.

Manuelli, F., and Mori, L. (2016). "The King at the Gate": Monumental Fortifications and the Rise of Local Elites at Arslantepe at the End of the 2nd Millennium BCE. *Origini*, 39, 209–42.

Marazzi, M. (1990). *Il Geroglifico Anatolico Problemi di Analisi e Prospettive di Ricerca* (Biblioteca di Ricerche Linguistiche e Filologiche 24). Dipartimento di Studi Glottoantropologici Università La Sapienza.

Marazzi, M. (1998). *Il geroglifico anatolico. Sviluppi della ricerca a venti anni dalla sua "ridecifrazione". Atti del Colloquio e della Tavola rotonda, Napoli-Procida, 5-9 Giugno 1995* (Seminario di Studi Asiatici: Series minor 57). Istituto Universitario Orientale.

Marazzi, M. (2007). Sigilli, sigillature e tavolette di legno: alcune considerazioni alla luce dei nuovi dati. In: M. Alparslan, M. D. Alparslan, H. Peker (eds), *VITA Festschrift in Honor of Belkıs Dinçol and Ali Dinçol*, Ege Yayınları, 465-474.

Marazzi, M. (2008). Messa a coltura e procedure di gestione e controllo dei campi nell'Anatolia hittita. Caratteristiche della documentazione e stato della ricerca. In: M. Perna, F. Pomponio (eds), *The Management of Agricultural Land and the Production of Textiles in the Mycenaean and Near Eastern Economies*, (Studi Egei e Vicino Orientali 4), De Boccard, 63-88.

Margaritis, E. and Jones, M. (2006). Beyond Cereals: Crop Processing and Vitis vinifera L. Ethnography, Experiment and Charred Grape Remains from Hellenistic Greece. *Journal of Archaeological Sciences*, 33, 784–805.

Märkle, T. and Rösch, M. (2008). Experiments on the effects of carbonization on some cultivated plant seeds. *Vegetation History and Archaeobotany*, 17, 257-263.

Marsh, B. (1999). Alluvial Burial of Gordion, an Iron-Age City in Anatolia. *Journal of Field Archaeology* 26(2): 163-175.

Marston, J. M. (2011). Archaeological markers of agricultural risk management. *Journal of Anthropological Archaeology*, 30(2), 190-205.

Marston, J. M. (2013). Modeling wood acquisition strategies from archaeological charcoal remains. *Journal of Archaeological Science*, 36(10), 2192-2200.

Marston, J. M. (2014). Ratios and Simple Statistics in Paleoethnobotanical Analysis Data Exploration and Hypothesis Testing. In: Marston, J. M., d'Alpoim Guedes, J. and Warinner, C. (eds), *Methods and Theory in Paleoethnobotany*. University Press of Colorado, 163-179.

Marston, J. M. (2017). *Agricultural Sustainability and Environmental Change at Ancient Gordion* (Gordion Special Studies 8). University of Pennsylvania Press.

Marston, J. M. (2021). Archaeological approaches to agricultural economies. *Journal of Archaeological Research*, 29(3), 327-385.

Marston, J. M., and Miller, N. F. (2014). Intensive agriculture and land use at Roman Gordion, central Turkey. *Vegetation History and Archaeobotany*, 23: 761–773.

Marston, J. M., d'Alpoim Guedes, J. and Warinner, C. (2014). *Methods and Theory in Paleoethnobotany*. University Press of Colorado.

Marston, J. M., Kováčik, P. and Schoop, U. D. (2021). Environmental reconstruction and wood use at Late Chalcolithic Çamlıbel Tarlası, Turkey. *Quaternary International*, 593/594, 178-194

Marston, J.M., and Branting, S. (2016). Agricultural adaptation to highland climate in Iron Age Anatolia. *Journal of Archaeological Science: Reports*, 9, 25–32.

Marston, J.M., Çakırlar, C., Luke, C., Kováčik, P., Slim, F.G., Shin, N., Roosevelt, C.H. (2021). Agropastoral Economies and Land Use in Bronze Age Western Anatolia. *Environmental Archaeology*, 1–15.

Marston, M. J. and Castellano, L. (2021). Archaeobotany of Anatolia. In: S. Steadman and G. McMahon (eds), *Archaeology of Anatolia Volume IV*, Cambridge Scholar Publishing: 338-354.

Marston, M. J., and Castellano, L. (forthcoming). Archaeobotanical Perspectives on Agriculture in Anatolia in the Long First Millennium CE. *Vegetation History and Archaeobotany*.

Martinoli, D. (2002). Les macrorestes botaniques de la Grotte d'Öküzini. In: I. Yalçinkaya, M. Otte, J. Kozlowski, O. Bar-Yosef (eds), *La Grotte d'Öküzini: Évolution du Paléolithique final du sud-ouest de l'Anatolie*, ERAUL. Université de Liège, 91-94.

Martinoli, D. (2004). Food plant use, temporal changes and site seasonally at Epipalaeolithic Öküzini and Karain B caves, southwest Anatolia, Turkey. *Paléorient*, 30, 61–80.

Martinoli, D. (2009). Reconstruction of local woodland vegetation and use of Þrewood at two Epipalaeolithic cave sites in southwest Anatolia (Turkey). In: Fairbairn, A.S., Weiss, E. (eds), *From Foragers to Farmers. Papers in Honour of Gordon C. Hillman*, Oxbow Books, 161–170.

Martinoli, D., and Jacomet, S. (2004). Identifying endocarp remains and exploring their use at Epipalaeolithic Okuzini in southwest Anatolia, Turkey. *Vegetation History and Archaeobotany*, 13, 45–54.

Martinoli, D., and Nesbitt, M. (2003). Plant stores at pottery Neolithic Höyücek, southwest Turkey. *Anatolian Studies*, 53, 17–32.

Masetti-Rouault, M. G. (2004). Pour le bien du mon peuple: continuité et innovation dans l'idéologie du pouvoir au Proche-Orient à l'âge du Fer. In: M. Mazoyer and O. Casabonne (eds), *Studia Anatolica et varia: Mélange offerts au Prof. René Lebrun, Vol. 2*, Editions L'Harmattan, 113–32.

Masi, A., Balossi Restelli, F., Sabato, D., Vignola, C., and Sadori, L. (2018). Timber exploitation during the 5th–3rd millennia BCE at Arslantepe (Malatya, Turkey): environmental constraints and cultural choices. *Archaeological and Anthropological Sciences*, 10, 465–483.

Masi, A., Sadori, L. Zanchetta, G., Baneschi, I. and Giardini, M. (2013a). Environmental reconstruction and wood use at Late Chalcolithic Çamlıbel Tarlası, Turkey. *Quaternary International*, 593/594, 178-194.

Masi, A., Sadori, L., Balossi Restelli, F., Baneschi, I. and Zanchetta, G. (2014). Stable carbon isotope analysis as a crop management indicator at Arslantepe (Malatya, Turkey) during the Late Chalcolithic and Early Bronze Age. *Vegetation History and Archaeobotany*, 23, 751-760.

Masi, A., Sadori1, L., Baneschi, I., Siani, A. M. and Zanchetta, G. (2013b). Stable isotope analysis of archaeological oak charcoal from eastern Anatolia as a marker of mid-Holocene climate change. *Plant Biology*, 15(1), 83-92.

Massa, M., Bachhuber, C., Şahin, F., Erpehlivan, H., Osborne, J., & Lauricella, A. J. (2020). A landscape-oriented approach to urbanisation and early state formation on the Konya and Karaman plains, Turkey. *Anatolian Studies*, 70, 45-75.

Matessi, A. (2016). The making of Hittite imperial landscapes: territoriality and balance of power in south-central Anatolia during the Late Bronze Age. *Journal of Ancient Near Eastern History*, 3(2), 117-162.

Matessi, A. (2021). The ways of an empire: Continuity and change of route landscapes across the Taurus during the Hittite Period (ca. 1650–1200 BCE). *Journal of Anthropological Archaeology*, 62, 101293.

Matessi, A., and Tommasini Pieri, B. M. (2017). Soith-Central Anatolia. In: M. Weeden, and L.Z. Ullmann (Eds), *Hittite Landscape and Geography* (Handbook of Oriental Studies. Section 1 The Near and Middle East 121), Brill, 89-105

Matessi, A., Capardoni, M., and Lanaro, A. (2014). Excavations at Kınık Höyük: a preliminary report on the first season (Aug.–Oct. 2011). In: *Proceedings of the 8th International Congress on the*

Archaeology of the Ancient Near East: 30 April - 4 May 2012, University of Warsaw, Harrassowitz Verlag, 321-40.

Matessi, A., Gürel, A., Kuzucuoğlu, C., and d'Alfonso, L. (2016). East of Konya: Settlements, Routes and Environment in Southern Cappadocia, and the Political Landscape of South Central Anatolia during the Second Millennium BCE. In: Hazirlayan Y, Maner C (Eds), *Crossroads. Konya Plain from Prehistory to the Byzantine Period*, Zero Prod. Ltd, 131–160

Matney T, Algaze G, and Pittman H. (1997). Excavations at Titris Höyük in southeastern Turkey: A preliminary report of the 1996 season. *Anatolica*, 23, 61-84.

Matney, T., Greenfield, T., Köroğlu, K., MacGinnis, J., Proctor, L., Rosenzweig, M., and Wicke, D. (2015). Excavations at Ziyaret Tepe, Diyarbakir province, Turkey, 2011-2014 seasons. *Anatolica*, 41: 125–176.

Mayewski, P. A., Rohling, E. E., Stager, J. C., Karlén, W., Maasch, K. A., Meeker, L. D., et al. (2004). Holocene climate variability. *Quaternary research*, 62(3), 243-255.

Mccobb, L. M. E., Briggs, D. E. G., Evershed, R. P., Hall, A. R., and Hall, R. A. (2001). Preservation of Fossil Seeds From a 10th Century AD Cess Pit at Coppergate, York. *Journal of Archaeological Science*, 28(9), 929-940.

Medović, A. (2008). Gamzigradski atari–dva koraka napred, jedan korak nazad. *RAD Muzeja Vojvodine*, 50, 151-173.

Megaloudi, F. (2005). Archeobotanical Finds from Ulucak, Western Turkey (İzmir Region): A

Preliminary Study. *Mediterranean Archaeology and Archaeometry*, 5: 27–32.

Melis, R., Bernasconi, M. P., Colizza, E., Di Rita, F., Schneider, E. E., Forte, E., et al. (2015). Late Holocene palaeoenvironmental evolution of the northern harbour at the Elaiussa Sebaste archaeological site (south-eastern Turkey): evidence from core ELA6. *Turkish Journal of Earth Sciences*, 24(6), 566-584.

Mellaart, J. (1954). Preliminary report on a survey of pre-Classical remains in southern Turkey. *Anatolian Studies*, 4, 175-240.

Mellaart, J. (1962). The Late Bronze Age Monuments of Eflatun Pınar and Fasıllar near Beyşehir. *Anatolian Studies*, 12: 111-117.

Mellaart, J. (1963). Early cultures of the south Anatolian plateau, II. *Anatolian Studies*, 13, 199-236.

Menotti, F. (2012). *Wetland archaeology and beyond: theory and practice*. Oxford University Press.

Meriggi, P. (1962) Alcuni monticoli di Kataonia. *Oriens Antiquus*, 1, 265-281.

Meriggi, P. (1963). Terzo viaggio anatolico. *Oriens Antiquus*, 2, 275-299,

Messager, E., Badou, A., Fröhlich, F., Deniaux, B., Lordkipanidze, D., Voinchet, P. (2010). Fruit and seed biomineralization and its effect on preservation. *Archaeological and Anthropological Sciences*, 2, 25–34

Michel, C. (2011). The Kārum Period on the Plateau. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia: (10,000-323 BCE)*, Oxford University Press.

Michel, C. (1997). A table avec les marchands paléo-assyriens. In: H. Waetzoldt and H. Hauptmann (eds), *Assyrien im Wandel der Zeiten: XXXIXe Rencontre assyriologique internationale, Heidelberg, 6.-10. Juli 1992* (Heidelberger Studien zum alten Orient 6), Heidelberger Orientverlag, 95-113.

Michel, C. (2005). Le commerce privé des Assyriens en Anatolie: un modèle du commerce archaïque selon K. Polanyi. In: P. Clancier, F. Joannès, P. Rouillard, and A. Tenu (eds), *Autour de Polanyi: vocabulaires, théories et modalités des échanges, textes du 1er Colloque de la Maison René-Ginouvès, Nanterre, 12-14 juin 2004* (Colloques de la Maison René-Ginouvès 1), De Boccard, 121-133.

Michels, C. (2013). Archelaos of Cappadocia. In: R. Bagnall et al. (eds), *The Encyclopedia of Ancient History*, Blackwell Publishing, 629-630.

Michels, C. (2017). The Persian Impact on Bithynia, Commagene, Pontus, and Cappadocia. In: S. Müller, T. Howe, H. Bowden, and R. Rollinger (eds), *The History of the Argeads: New Perspectives. With the collaboration of Sarina Pal* (Classica et orientalia 19), Harrassowitz Verlag, 41-56.

Miebach, A., Niestrath, P., Roeser, P., and Litt, T. (2016). Impacts of climate and humans on the vegetation in northwestern Turkey: palynological insights from Lake Iznik since the Last Glacial. *Climate of the Past*, 12(2), 575-593

Mielke, D. P. (2006). Inandiktepe und Sarissa. Ein Beitrag zur Datierung althethitischer Fundkomplexe. In: D. P. Mielke, U.-D. Schoop, and J. Seeher (eds), *Strukturierung und Datierung in der hethitischen Archäologie* (BYZAS 4), Ege Yayınları, 251–76.

Mielke, D. P. (2011a). Key Sites Of The Hittite Empire. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia:* (*10,000-323 BCE*), Oxford University Press.

Mielke, D. P. (2011b). Hittite cities - Looking for a concept. In: H. Genz and D. P. Mielke (eds), *Insights into Hittite History and Archaeology* (Colloquia Antiqua 2), Peeters, 153-194.

Miller, J. L. (2013). *Royal Hittite instructions and related administrative texts* (writings from the ancient world 31). SBL press.

Miller, N. F. (1984). The Use of Dung as Fuel: an Ethnographic Example and an Archaeological Application. *Paléorient*, 10(2), 71-79.

Miller, N. F. (1988). Ratios in paleoethnobotanical analysis. In: C. A. Hastorf, and V. S. Popper (eds), *Current paleoethnobotany: analytical methods and cultural interpretations of archaeological plant remains*, Chicago University Press, 72-85.

Miller, N. F. (1991). Plant Remains From Neolithic Gritille: Food and Fuel in the Context of Animal Domestication. *MASCA Ethnobotanical Laboratory Report*, 27, 1–12.

Miller, N. F. (1992). The Crusader period fortress: some archaeobotanical samples from Medieval Gritille. *Anatolica*, 28, 87–99.

Miller, N. F. (1994) *apud* Stein, G. J., and Mısır, A. (1994). Mesopotamian-Anatolian interaction at Hacinebi, Turkey: preliminary report on the 1992 excavations. *Anatolica*, 20, 145–189.

Miller, N. F. (1997). Farming and herding along the Euphrates: environmental constraint and cultural choice (fourth to second millennia BC). *MASCA Research Papers in Science and Archaeology*, 14, 123.

Miller, N. F. (1999). Interpreting ancient environment and patterns of land use change: seeds, charcoal and archaeological context. *TÜBA-AR*, 2, 15–29.

Miller, N. F. (2010). *Botanical Aspects of Environment and Economy at Gordion*, Turkey (Gordion Special Studies). University of Pennsylvania Press.

Miller, N. F., and Marston, J. M. (2012). Archaeological fuel remains as indicators of ancient West Asian agropastoral and land-use systems. *Journal of Arid Environments*, 86, 97-103.

Miller, N. F., and Redford, S. (1998). Patterns of Agriculture and Land Use at Medieval Gritille. In: S. Redford (ed), *The Archaeology of the Frontier in the Medieval Near East: Excavations at Gritille* (Archaeological Institute of America Monograph), Archaeological Institute of America, 211-252.

Miller, N. F., and Smart, T. L. (1984). Intentional Burning of Dung as Fuel: A Mechanism for the Incorporation of Charred Seeds into the Archeological Record. *Journal of Ethnobiology*. 4, 15-28.

Miller, N. F., Spengler, R. N., and Frachetti, M. (2016). Millet cultivation across Eurasia: Origins, spread, and the influence of seasonal climate. *The Holocene*, 26(10), 1566-1575.

Minnis, P. E. (1981). Seeds in Archaeological Sites: Sources and Some Interpretive Problems. *American Antiquity*, 46(1), 143-52.

Mitchell, S. (1993). *Anatolia. Land, Men, and Gods in Asia Minor. I, The Celts and the Impact of Roman*

Rule. Clarendon Press.

Mitchell, S. (2007). Iranian names and the presence of Persians in the religious sanctuaries of Asia Minor. In: E. Matthews (ed.), *Old and New Worlds in Greek Onomastics*, British Academy Scholarship Online.

Miyake, Y., Maeda, O., Tanno, K., Hongo, H., and Gündem, C. Y. (2012). New Excavations at Hasankeyf Höyük: A 10th Millennium cal. BC Site on the Upper Tigris, Southeast Anatolia. *Neo-Lithics*, 12(1), 3-7

Momot, J. (1955). Méthode pour l' étude de charbons de bois. *Bulletin de la Société Préhistorique Française*, 52, 141-142.

Mora, C. (2010). Studies on Ancient Anatolia at Pavia University, and the Hittite Lower Land. In: L. d'Alfonso, M. E. Balza, and C. Mora (eds) *Geo-Archaeological Activities in Southern Cappadocia, Turkey: Proceedings of the Meeting Held at Pavia, 20.11.2008,* Italian University Press, 13–25.

Mora, C. and d'Alfonso, L. (2012a). Anatolia after the End of the Hittite Empire: New Evidence from Southern Cappadocia. *Origini*, 34: 385–98.

Mora, C., and d'Alfonso, L. (2012b). Il progetto "Kınık Höyük": missione archeologica e ricerche storiche in Cappadocia meridionale (Turchia). *Athenaeum*, 100, 529-40.

Motuzaite-Matuzeviciute, G., Staff, R. A., Hunt, H. V., Liu, X., and Jones, M. K. (2013). The early chronology of broomcorn millet (Panicum miliaceum) in Europe. *Antiquity*, 87(338), 1073-1085.

Moulherat, C., Tengberg, M., Haquet, J. F., and Mille, B. (2002). First Evidence of Cotton at Neolithic Mehrgarh, Pakistan: Analysis of Mineralized Fibres from a Copper Bead. *Journal of Archaeological Science*, 29(12), 1393–1401.

Mudge, K., Janick, J., Scofield, S. and Goldschmidt, E.E. (2009). A History of Grafting. *Horticultural Reviews*, 35, 437-493.

Mudie, P. J., Rochon, A., and Aksu, A. E. (2002). Pollen stratigraphy of Late Quaternary cores from Marmara Sea: land–sea correlation and paleoclimatic history. *Marine Geology*, 190(1-2), 233-260.

Müllenhoff, M., Handl, M., Knipping, M., and Brückner, H. (2004). The evolution of Lake Bafa (Western Turkey)–Sedimentological, microfaunal and palynological results. *Coastline Reports*, 1(2004), 55-66.

Müller-Karpe, A. (2002). Kuşaklı-Sarissa: A Hittite Town in the "Upper Land". In: K. A. Yener and H. A. Hoffner Jr. (eds), *Recent Developments in Hittite Archaeology and History: Papers in Memory of Hans G. Guterbock*, Penn State University Press, 145-156.

Müller-Karpe, A. (2006). Untersuchungen in Kayahpinar 2005. *Mitteilungen der Deutschen Orient Gesellschaft zu Berlin*, 138, 211-247

Müller-Karpe, A., Müller-Karpe, V., Mielke, D. P., Schachner, A., Stümpel, H., Jean, E., and Pasternak, R. (1998). Untersuchungen in Kuşaklı 1997. *Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin*, 130, 93–174.

Müller-Karpe, A., Segschneider, M., and Stümpel, H. (1995). Untersuchungen in Kuşaklı 1992-94.

Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin, 127, 5–36.

Müller-Karpe, A., Wilhelm, G., Müller-Karpe, V., Tsumoto, H., Mielke, D. P., Wilms, M., and Pasternak, R. (2000). Untersuchungen in Kuşaklı 1999. *Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin*, 132, 311–353.

Naruse, T., Kitagawa, H., and Matsubara, H. (1997). Lake level changes and development of alluvial fans in Lake Tuz and the Konya basin during the last 24,000 years on the Anatolian plateau, Turkey. *Nichibunken Japan Review*, 8, 173-192.

Neef, R. (2001) *apud* Seeher, J. (2001). Die Ausgrabungen in Boğazköy-Ḫattuša 2000. *Archäologischer Anzeiger*, 335–341.

Neef, R., (2003). Overlooking the Steppe-Forest: A Preliminary Report on the Botanical Remains from Early Neolithic Göbekli Tepe (Southeastern Turkey). *Neo-Lithics*, 2, 13–16.

Neef, R., Cappers, R. T., and Bekker, R. M. (2012). *Digital atlas of economic plants in archaeology*. Barkhuis.

Nelle, O., Dreibrodt, S., Dannath, Y. (2010). Combining pollen and charcoal: evaluating Holocene vegetation composition and dynamics. *Journal of Archaeological Science*, 37, 2126-2135.

Nesbitt, M. (1995). Recovery of archaeological plant remains at Kaman-Kalehöyük. *Anatolian Archaeological Studies*, 7, 115–130.

Nesbitt, M. (1996). Chalcolithic Crops from Kuruçay Höyük. In: R. Duru (ed.), *Kuruçay Höyük II*, Türk

Tarih Kurumu, 134-137.

Nesbitt, M. (2016a). *Identification guide for Near Eastern grass seeds*. Routledge.

Nesbitt, M. (2016b). The plant remains. In: S. Blaylock, D. Collon, and M. Nesbitt (eds), *Tille Höyük 3. The Iron Age. Vol. 2. Pottery, Objects and Conclusions*, British Institute at Ankara, 369-394.

Nesbitt, M., and Mikasa, T. (1993). Ancient Crop Husbandry at Kaman-Kalehöyük: 1991 Archaeobotanical Report. In: *Essays on Anatolian Archaeology* (Bulletin of the Middle East Culture Center in Japan), Harrassowitz, 75–97.

Nesbitt, M., and Samuel, D. (1996a). Archaeobotany in Turkey: A Review of Current Research. *Orient-Express*, 91-96.

Nesbitt, M., and Samuel, D. (1996b). From staple crop to extinction? The archaeology and history of the hulled wheats. In: S. Padulosi, K. Hammer, and J. Heller (eds), *Hulled wheats. Proceedings of the First International Workshop on Hulled Wheats. Promoting the conservation and use of underutilized and neglected crops*, IPGRI, 40-99.

Nesbitt, M., Bates, J., Hillman, G., and Mitchell, S. (2017). *The archaeobotany of Aşvan: environment & cultivation in Eastern Anatolia from the Chalcolithic to the Medieval period*. British Institute at Ankara.

Neve, P. (1990). Die Ausgrabungen in Bogazköy-Hattuša 1989. *Archäologischer Anzeiger*, 267-303.

Oates, D., and Oates, J. (1977). Early irrigation agriculture in Mesopotamia. In: G. Sieveking, I. H., Longworth, and K. E. Wilson (eds), *Problems in economic and social archaeology*, Duckworth, by 109-135.

Ocakoğlu, F., Dönmez, E. O., Akbulut, A., Tunoğlu, C., Kır, O., Açıkalın, S., et al. (2016). A 2800-year multi-proxy sedimentary record of climate change from Lake Çubuk (Göynük, Bolu, NW Anatolia). *The Holocene*, 26(2), 205-221.

Ocakoğlu, F., Kır, O., Yılmaz, İ. Ö., Açıkalın, S., Erayık, C., Tunoğlu, C., and Leroy, S. A. (2013). Early to Mid-Holocene Lake level and temperature records from the terraces of Lake Sünnet in NW Turkey. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 369, 175-184.

Oksanen, J., Blanchet, G., Frienfly, M., Kindt, R., Legendre, P., et al. (2019). *Vegan: Community Ecology Package. R Package Version 2.5-6.* http:// https://cran.r-project.org/web/packages/vegan/vegan.pdf. (accessed April 16, 2022).

Ökse A.T., Oybak Dönmez, E., Görmüş, A., Gürbüz, M., Özdeğer, M. (2012). The Middle Bronze Age Farming Economy of the Upper Tigris Region: A Reconstruction Basing on Archaeological, Archaeobotanical and Ethnoarchaeological Analysis. *Akkadica*, 133, 1–40.

Omura, S. (2011). Kaman-kalehöyük Excavations in Central Anatolia. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia:* (*10,000-323 BCE*), Oxford University Press.

Oreshko, R. (2020). The onager kings of Anatolia: Hartapus, Gordis, Muška and the steppe strand in early Phrygian culture. *Kadmos*, 59(1/2), 77–128.

Osborne, J., Massa, M., Şahin, F., Erpehlivan, H., and Bachhuber, C. (2020). The city of Hartapu: Results of the Türkmen-Karahöyük Intensive Survey Project. *Anatolian Studies*, 70, 1-27.

Otten, H. (1981). *Die Apologie Hattusilis III. Das Bild der Überlieferung* (Studien zu den Bogazkoy-Texten 24). Harrassowitz.

Owen, D. I. (1981). An Akkadian Letter from Ugarit at Tel Aphek. *Tel Aviv*, 8(1), 1–17.

Oybak Dönmez E. (2014). Tarih Öncesinde Yenibademli Höyük'te (Gökçeada) Tarım. In: B. Öztürk, and Y. Pazarkaya (eds), *Gökçeada Doğa ve Kültür Varliklari*, Cem Yayınevi, 69-80.

Oybak Dönmez E. (2018). Arkeobotanik Veriler. Ilısu Höyüğü Geç Roma Dönemi Arkeobotanik Buluntuları – Archaeobotanical Data. Late Roman Archaeobotanical Remains from Ilısu Höyük. In: A. Tuba Ökse and N. Erdoğan (eds), *Ilısu Barajı İnşaat Sahası Kurtarma Kazıları III: Roma İmparatorluk Dönemi ve Orta-Yakın Çağ Yerleşmeleri*, Mardin Müze Müdürlüğü, 390-396.

Oybak Dönmez, E. (2003). Urartian crop plant remains from Patnos (Ağri), eastern Turkey. *Anatolian Studies*, 53: 89–95.

Oybak Dönmez, E. (2005). Early Bronze Age Crop Plants from Yenibademli Höyük (Gökçeada), Western Turkey. *Environmental Archaeology*, 10, 39–49.

Oybak Dönmez, E. (2006a). Liman Tepe (İzmir) Erken Tunç Çağı tarla bitkileri. In: A. Erkanal-Öktü (ed.), *Prof. Dr. Hayat Erkanal'a Armağan: Kültürlerin Yansimasi*, Homer Kitabevi, 541-553.

Oybak Dönmez, E. (2006b). Plant Use at Gre Virike (Sanliurfa, Turkey). In:), Z.F. Ertuğ (ed.), *Proceedings of the Fourth International Congress of Ethnobotany* (*ICEB, 2005*)*: 21-26 August 2005, Istanbul*

(*Turkey*), Efe Yayınları, 349-441.

Oybak Dönmez, E. (2006c). Prehistoric and Medieval Plant Remains from Two Sites on the Euphrates, South-eastern Turkey. *Turkish Journal of Botany*, 30, 11–38.

Oybak Dönmez, E. (2010). İstanbul Marmaray ve Metro kazılarında yapılan arkeobotanik çalışmalar. In: *Marmaray-Metro Kurtarma Kazıları Sempozyumu Bildiriler Kitabı, 5-6 Mayıs 2008*, İstanbul Arkeoloji Müzeleri Müdürlüğü, 233-248.

Oybak Dönmez, E. (2015). Kumru Tarlası (Zeviya Tivilki) Arkeobotanik Buluntuları Burçak Tohumları. In: A.T. Ökse, A. Görmüş, E. Atay, and N. Erdoğan (eds), *Ilisu Baraji Inşaat Sahasi Kurtarma Projesi I: Demir Caği*, Mardin Müze Müdürlüğü, 263-267.

Oybak Dönmez, E. (2019). Hitit şehri Şapinuva'da (Ortaköy - Çorum) arkeobotanik buluntular. In: *Acts of the IX International Congress of Hittitology*, II, İl Kültür ve Turizm Yayınları, 669-683.

Oybak Dönmez, E., Akyol, A. A., Karadağ, R., Torgan, E., and İren, K. (2016). Ancient plant remains with special reference to buckthorn, Frangula alnus Mill., pyrenes from Dascyleum, Balıkesir, NW Turkey. *Acta Societatis Botanicorum Poloniae*, 86, 1-16.

Oybak Dönmez, E., Akyol, A.A., and Iren, K. (2014). Traces of Glossy Buckthorn in Daskyleion An Old Household Remedy and Coloring Matter. *Actual Archaeology Magazine Anatolia*, 11: 14–15.

Oybak Dönmez, E., and C. Doğan. (2008). Plant Remains from Liman Tepe and Bakla Tepe in The Izmir Region. In: E. Hayat, H. Hauptmann, V. Sahoglu, R. Tuncel (eds), *The Aegean in the Neolithic, Chalcolithic and the Early Bronze Age*, AU Sualti Arkeolojik Arastirma ve Uygulama Merkezi,

398-406.

Oybak Dönmez, E., and O. Belli. (2007). Urartian Plant Cultivation at Yoncatepe (Van), Eastern Turkey. *Economic Botany*, 61, 290–298.

Oybak Dönmez, E., and Ş. Demirci. (1997). Early Bronze Age Plant Remains from İmamoğlu Höyük, SE Turkey. *Anatolian Studies*, 47, 173–176.

Oybak Dönmez, E., Ocakoğlu, F., Akbulut, A., Tunoğlu, C., Gümüş, B. A., Tuncer, A., et al. (2021). Vegetation record of the last three millennia in central Anatolia: Archaeological and palaeoclimatic insights from Mogan Lake (Ankara, Turkey). *Quaternary Science Reviews*, 262, 106973.

Özalp, İ., Caner, H., Kılıç, N. K., and Avcı, M. (2017). Analysis of fossil pollen record from the Late Holocene in the Turkish Highland (Middle Taurus, Turkey). *Ecological Questions*, 26, 91-94.

Özbal, R., Gerrisen, F., Diebold, B., Healey, E., Aydin, N., Loyet, M., Nardulli, F., Reese, D., Ekstom, H., Sholts, S., Mekel-Bobrov, N., and Lahn, B. (2004). Tell Kurdu Excavations 2001. *Anatolica*, 30, 37–107.

Özbaşaran, M. (2000). The Neolithic Site of Musular, Central Anatolia. *Anatolica*, 26, 129–151.

Özbaşaran, M. (2011). Re-starting at Aşıklı. *Anatolia antiqua*, 19, 27-37.

Özbaşaran, M., and Endogru, M. (2001). Musular kazısı 1999. *Kazi Sonunclari Toplantisi*, 22, 73–82.

Özbaşaran, M., Bucak, E., and Molist, M. (2007). Akarçay Tepe 2005. *Kazi Sonunclari Toplantisi*, 28, 187–

202.

Özgüç, N. (1966). Excavations at Acemhöyük. *Anatolia,* 10, 29-52.

Özgüç, T. (1978). *Excavations At Masat Höyük And Investigations In Its Vicinity.* Türk Tarih Kurumu.

Özgüç, T. (1982). *Masat Hoyuk II: A Hittite center northeast of Bogazkoy*. Türk Tarih Kurumu.

Özgüç, T. (1988). *İnandıktepe: eski Hitit çağında önemli bir kült merkezi.* Türk Tarih Kurumu.

Özgüç, T. (2003). *Kültepe. Kaniş /Neşa: The Earliest International Trade Center and the Oldest Capital City of the Hittites*. The Middle Eastern Culture Center in Japan.

Özyar, A., Ünlü, E, and Pilavci, Y. (2020). Tarsus-Gözlükule kazilari 2018 yili çalişmalari. *Kazi Sonunclari Toplantisi*, 41, 203–216.

Pagnoux, C., Bouby, L., Ivorra, S., Petit, C., Valamoti, S. M., Pastor, T., et al. (2015). Inferring the agrobiodiversity of Vitis vinifera L.(grapevine) in ancient Greece by comparative shape analysis of archaeological and modern seeds. *Vegetation History and Archaeobotany*, 24(1), 75-84.

Pagnoux, C., Bouby, L., Valamoti, S. M., Bonhomme, V., Ivorra, S., Gkatzogia, E., et al. (2021). Local domestication or diffusion? Insights into viticulture in Greece from Neolithic to Archaic times, using geometric morphometric analyses of archaeological grape seeds. *Journal of Archaeological Science*, 125, 105263.

Palmer, C. (1998). The role of fodder in the farming system: a case study from northern Jordan. *Environmental Archaeology*, 1(1), 1-10.

Palumbi, G., Alvaro, C., Grifoni, C., Frangipane, M., Vignola, C., and Terrasi, F. (2017). A 'communal' building of the beginning of the Early Bronze Age at Arslantepe-Malatya (Turkey). Spatio-functional analysis and interpretation of the archaeological context. *Paléorient*, 43(1), 89–123.

Pamisano, A. (2018). *The Geography of Trade. Landscapes of competition and long-distance contacts in Mesopotamia and Anatolia in the Old Assyrian Colony Period*. Archaeopress.

Pamuk Ş. (1987). *The Ottoman Empire and European Capitalism, 1820–1913: Trade, Investment and Production*. Cambridge University Press.

Pan, C., Zhao, H., Zhao, X., Liu, J., Liu, L., Hou, Y., and Zhang, L. (2011). Pollination ecology and breeding system of Elaeagnus angustifolia. *International Conference on Multimedia Technology*. Hangzhou 2011, 4507-4509.

Panagiotakopulu, E., and Buckland, P. C. (2017). A thousand bites–Insect introductions and late Holocene environments. *Quaternary Science Reviews*, 156, 23-35.

Panichi, S. (2009). Cappadocia through Strabo's eyes. In: D. Dueck, H. Lindsay, and S. Pothecary (eds), *Strabo's Cultural Geography: The Making of a Kolossourgia*, Cambridge University Press, 200-215

Panichi, S. (2017). La Cappadocia Tra Iranismo e Ellenismo. *Sileno*, XLIII(1-2), 165-181.

Panichi, S. (2018). *La Cappadocia Ellenistica Sotto gli Ariaratidi (Ca. 250-100 a.C.)*. Casa Editrice Leo S. Olschki.

Papadopoulou, I., and Bogaard, A. (2012) *apud* Schachner, A. (2012). Die Ausgrabungen in Boğazköy-

Ḫattuša 2011. *Archäologischer Anzeiger*, 123-133.

Parker, B.J., Creekmore, A., Swartz Dodd, L., Meegan, C., Mosemann, E., Paine, R., Abraham, M., and Cobb, P. (2003). The Upper Tigris Archaeological Research Project (UTARP). *Anatolica*, 29, 103–174.

Parpola (1987). The Correspondence of Sargon II, Part 1: Letters from Assyria and the West (State Archives of Assyria 1). Helsinki University Press.

Pasternak, R. (1997). Zwischenbericht über die Arbeiten an den botanischen Funden aus Oylum Höyük: halkolithische Fundschichten. *Istanbuler Mitteilungen*, 47, 68 - 70.

Pasternak, R. (1998). Investigations of Botanical Remains from Nevali Cori PPNB, Turkey: A Short Interim Report. In: A.B. Damania, J. Valkoun, G. Willcox, C.O. Qualset (eds), *The Origins of Agriculture and Crop Domestication. Proceedings of the Harlan Symposium, 10-14 May 1997, Aleppo, Syria*, ICARDA, IPGRI, FAO, and UC/GRCP, 170-177.

Pasternak, R. (2012) *apud* Schachner, A., (2012). Die Ausgrabungen in Boğazköy-Ḫattuša 2011. *Archäologischer Anzeiger*: 85–137

Payne, A. (2012). *Iron Age Hieroglyphic Luwian Inscriptions* (Writing from Ancient World 26). Society of Biblical Literature.

Payne, A. and Wintjes, J. (2016). *Lords of Asia Minor: An Introduction to the Lydians*. Wiesbaden.

Pearsall, D. M. (2015). *Paleoethnobotany: A Handbook of Procedures*, 3rd edition. Routledge.

Peker, N. (2020). Agricultural production and installations in Byzantine Cappadocia: a case study focusing on Mavrucandere. *Byzantine and Modern Greek Studies*, 44(1), 40-61.

Peña-Chocarro, L. (1999) *Prehistoric agriculture in Southern Spain during the Neolithic and the Bronze Age; the application of ethnographic models* (BAR International Series 818). British Archaeological Reports.

Percival, J. (1974). *The Wheat Plant*. Duckworth

Perlin, J. (2005). *A Forest Journey: The Story of Wood and Civilization*. Countryman Press.

Perret, M. (1997). Polymorphisme des génotypes sauvages et cultivés de Vitis vinifera L., détecté à l'aide de marqueurs RAPD. *Bulletin de la société neuchâteloise des sciences naturelles*, 120, 45–54

Pfeifer, W. (1957). *Die PaBlandschaft von Niğde*. Gieben.

Piccione, P., Alvaro, C., Bartosiewicz, L., Lemorini, C., Masi, A., and Sadori, L. (2015). Distribution of artifacts and ecofacts in an Early Bronze Age house in Eastern Anatolia: Space use and household economy at Arslantepe VI B2 (2900–2750 BCE). *Journal of Archaeological Science: Reports*, 4, 8–22.

Picornell, G. L., Asouti, E., and Martí, E. A. (2011). The ethnoarchaeology of firewood management in the Fang villages of Equatorial Guinea, central Africa: Implications for the interpretation of wood fuel remains from archaeological sites. *Journal of Anthropological Archaeology*, 30, 375–384.

Picornell-G. L., Dufraisse, A., de Luís, M., Mus A. M., and Carrión M. (2020). Yolanda. Modelling dendro-anthracological parameters with dendrochronological reference datasets: interrogating the applicability of anthraco-typology to assess Aleppo pine (Pinus halepensis Miller) wood management from archaeological charcoal fragments. *Journal of Archaeological Science*, 124, 105265.

Pidek, I., Svitavská-Svobodová, H., van der Knaap, W., and Magyari, E. (2013). Pollen percentage thresholds of Abies alba based on 13-year annual records of pollen deposition in modified Tauber traps: perspectives of application to fossil situations. *Review of Palaeobotany and Palynology*, 195, 26-36.

Pique, R., and Mensua, C. (2007). Akarçay Tepe and Tell Halula: palaeoenvironmental reconstruction. In: R. Buxó, and M. M. Montaña (eds), *MENMED: from the adoption af agriculture to the current landscape: long-term interaction between men and environment in the East Mediterranean Basin; European Project ICA3-CT-2002-10022 Barcelona 2007*, Museu Arqueologia de Catalunya-Barcelona, 23–28.

Pişkin, E., and Tatbul, M. N. (2015). Archaeobotany at Komana: Byzantine plant use at a rural cornucopia. In: D.B. Erciyas, and M.N. Tatbul (eds), *The Medieval Settlement at Komana / Komana Ortacağ Yerleşimi*, Ege Yayınları, 139-166.

Plarre, R. (2013). An attempt to reconstruct the natural and cultural history of the granary weevil, Sitophilus granarius (Coleoptera: Curculionidae). *EJE*, 107(1), 1-11.

Poblome, J., Uleners, H., Uytterhoeven, I., Marinova, E., and De Cupere, B. (2015). The 2012 to 2014

Excavation Campaigns at Site LE, Sagalassos. The Structural Remains and General Phasing. *Anatolica*, 41, 203–240.

Pollock, S. (2012). Politics of food in early Mesopotamian centralized societies. *Origini*, 34, 153-168.

Popko, M. (1995). *Religions of Asia Minor*. Academic Publications Dialog.

Popovtschak, M. (2001). Archaobotanik: pflanzenreste aus dem Artemision von Ephesos. In: U. Muss, (ed.), *Der Kosmos Der Artemis von Ephesos, Sonderschriften*, Österreichisches Archäologisches Institut, 199-206.

Postgate, J. N., (2017). *Excavations at Kilise Tepe 2007–2011: The Late Bronze and Iron Ages*. https://tinyurl.com/kilisetepe (accessed September 16, 2018).

Postgate, J. N., and Thomas, D. (2007). *Excavations at Kilise Tepe, 1994–98: From Bronze Age to Byzantine in Western Cilicia* (BIAA Monograph 30). McDonald Institute/British Institute at Ankara.

Potts, D. T. (1997). *Mesopotamian civilization: the material foundations*. Cornell University Press.

Powell, M. A. (2003-2005). Obst und Gemiise. Mesopotamien *Reallexikon der Assyriologie*, 10, 13-22

Prentice, C. I. (1988). Records of vegetation in time and space: the principles of pollen analysis. In: B. Huntley, and T. Webb III (eds), *Vegetation History. Handbook of Vegetation Science* (7). Kluwer Academic Publishers, 17-42.

Prentice, I. C. (1985). Pollen representation, source area, and basin size: toward a unified theory of pollen analysis. *Quaternary Research*, 23(1), 76-86.

Punt, W., et al. (1976–2009). *The Northwest European Pollen Flora*. Elsevier.

Pustovoytov, K. E., Riehl, S., and Mittmann, S. (2004). Radiocarbon age of carbonate in fruits of Lithospermum from the early Bronze Age settlement of Hirbet ez-Zeraqon (Jordan). *Vegetation History and Archaeobotany*, 13, 207-212.

Quataert, D. (1968). Famine in Turkey, 1873–1875. *Regional Studies* 201, 1-54.

Quataert, D. (1977). Limited revolution: The impact of the Anatolian railway on Turkish transportation and the provisioning of Istanbul, 1890–1908. *Business History Review*, 51(2), 139-160.

Ramsay, J., and Eger, A.A. (2015). Analysis of Archaeobotanical Material from the Tüpraş Field Project of the Kinet Höyük Excavations, Turkey. *Journal of Islamic Archaeology*, 2, 35–50.

Ramsay, W. M. (1903). Cilicia, Tarsus, and the great taurus pass. *The Geographical Journal*, 22(4), 357-410.

Rapp, G., and Hill, C. L. (2006). *Geoarchaeology: The Earth-Science Approach to Archaeological Interpretation*. 2nd Edition. Yale University Press

Rast-Eicher, A., Karg, S., Bender Jørgensen, L. (2021). The use of local fibres for textiles at Neolithic Çatalhöyük. *Antiquity*, 95, 1129–1144.

Record, S. (1937). Wood. In: H.H. van der Osten, *The Alishar Huyuk Seasons of 1930-32. Part III* (Oriental Institute Publications 30), University of Chicago Press, 329-332.

Reddy, S. N. (1998). Fueling the hearths in India: the role of dung in paleoethnobotanical interpretation.

Paléorient, 24(2), 61-70.

Reimer, P. J., Austin, W. E., Bard, E., Bayliss, A., Blackwell, P. G., Ramsey, C. B., et al. (2020). The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon*, 62(4), 725-757.

Reisman, A. (2007). German Jewish Intellectuals' Diaspora in Turkey: 1933–55. *The Historian*, 69(3), 450-478.

Renfrew, C. (1972). *The Emergence of Civilisation: The Cyclades and the Aegean in the Third Millennium BC*. Methuen.

Renfrew, J. M. (1968). A Note on the Neolithic Grain from Can Hasan. *Anatolian Studies*, 18, 55–56.

Renfrew, J. M. (1973). *Palaeoethnobotany: The Prehistoric Food Plants of the Near East and Europe*. Columbia University Press.

Reynolds, A. G., and Vanden Heuvel, J. E. (2009). Influence of Grapevine Training Systems on Vine Growth and Fruit Composition: A Review. *American Journal of Enology and Viticulture*, 60(3), 251-268.

Riehl, S. (1994). Vorbericht zur botanischen Auswertung von Proben aus der Unterstadt von Troia VI. *Studia Troica*, 4, 68–72.

Riehl, S. (1999a). *Bronze Age Environment and Economy in the Troad. The Archaeobotany of Kumtepe and Troy*. Mo Vince Verlag.

Riehl, S. (1999b). Archäobotanik in der Troas. *Studia Troica*, 9, 367–409.

Riehl, S. (2009). Archaeobotanical evidence for the interrelationship of agricultural decision-making and climate change in the ancient Near East. *Quaternary International*, 197(1-2), 93-114.

Riehl, S. (2010). Flourishing agriculture in times of political instability – the archaeobotanical and isotopic evidence from Tell Atchana. In A. Yener (ed.,) *Tell Atchana, Ancient Alalakh. The 2003-2004 Excavations Seasons*, Koç Üniversitesi Yayınları, 123-136.

Riehl, S. (2019). Barley in archaeology and early history. In: *Oxford Research Encyclopedia of Environmental Science*.

Riehl, S., Benz, M., Conard, N. J., Darabi, H., Deckers, K., Nashli, H. F., and Zeidi-Kulehparcheh, M. (2012). Plant use in three Pre-Pottery Neolithic sites of the northern and eastern Fertile Crescent: a preliminary report. *Vegetation History and Archaeobotany*, 21, 95–106.

Riehl, S., Pustovoytov, K. E., Weippert, H., Klett, S., and Hole, F. (2014). Drought stress variability in ancient Near Eastern agricultural systems evidenced by S13C in barley grain. *PNAS*, 111, 12348-12353.

Risch, R. (2016). How did wealth turn into surplus profit? From affluence to »scarcity« in prehistoric economies. In: H. Meller, R. Jung, and R. Risch (eds), *Rich and Poor - Competing for resources in prehistoric societies* (Tagungen des Landesmuseums für Vorgeschichte Halle 14), Landesmuseum für Vorgeschichte, 33-48.

Rivera, D., Matilla, G., Obón, C., and Alcaraz, F. (2011). *Plants and Humans in the Near East and the*

Caucasus: Ancient and Traditional Uses of Plants as Food and Medicine. An Ethnobotanical Diachronic Review. Vol. 2 The Plants: Angiosperms. Editum.

Roaf, M. (1983). Sculptures and Sculptors at Persepolis. *Iran*, 21, 1-164.

Roberts, L. (1963). *Noms indigènes dans l'Asie Mineure gréco-romaine*. Jean Maisonneuve Edition.

Roberts, N. (2018). Revisiting the Beyşehir Occupation Phase: Land-Cover Change and the Rural Economy in the Eastern Mediterranean During the First Millennium AD. In: A. Izdebski, and M. Mulryan (eds), *Environment and Society in the Long Late Antiquity* (Late Antique Archaeology 11), Brill, 53-68.

Roberts, N., Allcock, S. L., Arnaud, F., Dean, J. R., Eastwood, W. J., Jones, M. D., et al. (2016). A tale of two lakes: a multi-proxy comparison of Lateglacial and Holocene environmental change in Cappadocia, Turkey. *Journal of Quaternary Science*, 31(4), 348-362.

Roberts, N., Black, S., Boyer, P., Eastwood, W. J., Griffiths, H. I., Lamb, H. F., et al. (1999). Chronology and stratigraphy of Late Quaternary sediments in the Konya Basin, Turkey: results from the KOPAL Project. *Quaternary Science Reviews*, 18(4-5), 611-630.

Roberts, N., Brayshaw, D., Kuzucuoğlu, C., Perez, R., and Sadori, L. (2011). The mid-Holocene climatic transition in the Mediterranean: Causes and consequences. *The Holocene*, 21(1), 3-13.

Roberts, N., Eastwood, W. J., and Carolan, J. (2009). Palaeolimnological Investigations in Paphlagonia. In: C. Glatz, R. Matthews (eds), *At Empire's Edge: Project Paphlagonia: Regional Survey in North Central Turkey* (BIAA Monograph Series), British Institute at Ankara, 64-73.

Roberts, N., Reed, J. M., Leng, M. J., Kuzucuoğlu, C., Fontugne, M., Bertaux, J., et al. (2001). The tempo of Holocene climatic change in the eastern Mediterranean region: new high-resolution crater-lake sediment data from central Turkey. *The Holocene*, 11(6), 721-736.

Rolinec, M., Bíro, D., Šimko, M., Juráček, M., Hanušovský, O., Schubertová, Z., et al. (2021). Grape Pomace Ingestion by Dry Cows Does Not Affect the Colostrum Nutrient and Fatty Acid Composition. *Animals*, 11(6), 1633.

Roller, D. W. (2014). *The Geography of Strabo: An English Translation, with Introduction and Notes*. Cambridge University Press.

Roller, D. W. (2018). *A Historical and Topographical Guide to the Geography of Strabo*. Cambridge University Press

Roller, L. E. (2011). Phrygian and the Phrygians. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia:* (*10,000-323 BCE*), Oxford University Press.

Roosevelt, C. H. (2009). *The Archaeology of Lydia, from Gyges to Alexander*. Cambridge University Press.

Roosevelt, C., Luke, C., Ünlüsoy, S., Çakırlar, C., Marston, J. M., O'Grady, C. R., Pavúk, P., Pieniążek, M., Mokrišová, J., Scott, C. B., Shin, N., and Slim, G. G. (2018). Exploring Space, Economy, and Interregional Interaction at a Second Millennium B.C.E. Citadel in Central Western Anatolia: 2014–2017 Research at Kaymakçı. *American Journal of Archaeology*, 122, 645–688.

Rosada, G., and Lachin, M. T. (2012). Excavations At Tyana/Kemerhisar, 2010. *Kazi Sonuçlari Toplantisi*, 33(3), 77-96.

Rose, C. B. (2012). *The Archaeology of Phrygian Gordion, Royal City of Midas* (Gordion Special Studies 7). University of Pennsylvania Press.

Rose, C. B. and Darbyshire, G. (2011). *The New Chronology of Iron Age Gordion* (Gordion special studies 6), University of Pennsylvania Museum of Archaeology and Anthropology.

Rosenberg, M., Nesbitt, M., and Strasser, T. F. (1995). Hallan Çemi Tepesi I: some preliminary observations concerning Early Neolithic subsistence behaviors in Eastern Anatolia. *Anatolica*, 21, 3–12.

Rosenberg, M., Nesbitt, M., Redding, R. W., and Peasnall, B. L. (1998). Hallan Çemi, pig husbandry, and post-Pleistocene adaptations along the Taurus-Zagros Arc (Turkey). *Paléorient,* 24, 25–41.

Rosenzweig, M. S. (2014). *Imperial environments: the politics of agricultural practice at Ziyaret Tepe, Turkey in the first millennium BCE* (PhD dissertation). University of Chicago, Chicago.

Rosenzweig, M. S., & Marston, J. M. (2018). Archaeologies of empire and environment. *Journal of Anthropological Archaeology*, 52, 87-102.

Ross, J. (2010). Çadir Höyük: The Upper South Slope 2006–2009. *Anatolica*, 36, 67-87.

Ross, J. C., McMahon, G., Heffron, Y., Adcock, S. E., Steadman, S. R., Arbuckle, B. S., Smith, A., and von Baeyer, M. (2019). Anatolian Empires: Local Experiences from Hittites to Phrygians at Çadır Höyük. *Journal of Eastern Mediterranean Archaeology and Heritage Studies*, 7(3), 299-320.

Rössner, C., Deckers, K., Benz, M., Özkaya, V., and Riehl, S. (2018). Subsistence strategies and vegetation development at Aceramic Neolithic Körtik Tepe, southeastern Anatolia, Turkey. *Vegetation History and Archaeobotany*, 27, 15–29.

Rothman, M.S., Ergeç, R., Miller, N. F., and Kozbe, G. (1998). Yarim Höyük and the Uruk Expansion. *Anatolica*, 24, 65–99.

Russi, L., Cocks, P. S., and Roberts, E. H. (1992). The fate of legume seeds eaten by sheep from a Mediterranean grassland. *Journal Applied Ecology*, 29, 772-778.

Ruster, C., and Wilhelm, G. (2012). *Landschenkungsurkunden Hethitischer Konige* (Studien Zu Den Bogazkoy-Texten Beiheft 4). Harrassowitz.

Sabanov, A. (2018). *Food and Fodder from the Early Bronze Age I Village at Arslantepe* (*Malatya, Turkey*)*: an Archaeobotanical Approach* (Master thesis). Sapienza University of Rome, Rome.

Sadori, L. and Masi, A. (2012). Archaeobotanical research at Arslantepe: traditional approach and new challenges. *Origini*, 34, 433–446.

Sadori, L., Susanna, F., and Balossi Restelli, F. (2008). Collapsed Beams and Wooden Remains from a 3200 BC Temple and Palace at Arslantepe (Malatya, Turkey). In: G. Fiorentino, D. Magri (eds), *Charcoals from the Past: Cultural and Palaeoenvironmental Implications*, BAR International Series, 237–250.

Sadori, L., Susanna, F., and Persiani, C. (2006). Archaeobotanical data and crop storage evidence from an early Bronze Age 2 burnt house at Arslantepe, Malatya, Turkey. *Vegetation History and Archaeobotany*, 15, 205–215.

Saffray, D. (1876). Les antiquities peruviennes a l'exposition de Philadelphia. *La Nature*, 4, 401-407.

Salih, B., Sipahi, T., and Oybak Dönmez, E. (2009). Ancient nigella seeds from Boyalı Höyük in north-central Turkey. *Journal of Ethnopharmacology*, 124, 416–420.

Salisbury, K.J., and Jane, F.W. (1940). Charcoals from Maiden Castle and their significance in relation to the vegetation and climatic conditions in prehistoric times. *Journal of Ecology*, 28, 310–325.

Sams, G. K. (1994). *Gordion IV: the Early Phrygian Pottery* (University Museum Monograph 74). University Museum, University of Pennsylvania.

Sams, G. K. (2011). Anatolia: the first millennium B.C.E. in Historical context. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia:* (*10,000-323 BCE*), Oxford University Press.

Samuel, D. (1993). A new look at old bread: ancient Egyptian baking. *Archaeology International*, 28-31.

Samuel, D. (1994). *An Archaeological Study of Baking and Bread in New Kingdom Egypt* (PhD Dissertation). University of Cambridge.

Savard, M. (2018). Archaeobotanical and Geographical Perspectives on Subsistence and Sedentism: The Case of Hallan Çemi (Turkey). In: E. Lightfoot, X. Liu, D.Q. Fuller (eds), *Far from the Hearth. Essays in Honour of Martin K. Jones*, McDonald Institute for Archaeological Research, 118-125.

Savard, M., Nesbitt, M., and Jones, M. K. (2006). The role of wild grasses in subsistence and sedentism: new evidence from the northern Fertile Crescent. *World Archaeology*, 38, 179–196.

Schachner, A. (1999). *Von Der Rundhütte Zum Kaufmannshaus: Kulturhistorische Untersuchungen Zur Entwicklung Prähistorischer Wohnhäuser In Zentral, Ost Und Südostanatolien* (BAR International Series 807). British Archaeological Reports.

Schachner, A. (2009). Das 16. Jahrhundert v. Chr.—eine Zeitenwende im hethitischen Zentralanatolien. *Istanbuler Mitteilungen*, 59, 9-34.

Schachner, A. (2011). *Hattuscha. Auf der Suche nach dem sagenhaften Großreich der Hethiter*. C. H. Beck.

Schachner, A. (2017a). Die Rolle der hethitischen Hauptstadt Hattuša für die Transformation des hethitischen Reichs. In: A. Schachner (ed.), Innovation versus Beharrung Was macht den Unterschied des hethitischen Reichs im Anatolien des 2. Jahrtausends v. Chr.?, (BYZAS 23), Yayınları, 219-239.

Schachner, A. (2017b). Hattusa and its Environs: Archaeology. In: M. Weeden and L. X. Ullmann (eds), Hittite Landscape and Geography (Handbook of Oriental Studies 121), Brill, 37-49.

Schachner, A. (2017c). The Historical Development of the Urban Geography of Hattuša, the Hittite capital City, and Beyond. In: M. Arpaslan (ed.), *Places and Spaces in Hittite Anatolia I: Hatti and the East*, Türk Eskiçağ Bilimleri Enstitüsü, 29-51.

Schachner, A. (2022). Geographical Prerequisites versus Human Behavior: Settlement Geography, Rural Economy, and Ideological Aspects of Anthropogenic Relations with the Natural Environment during the Second Millennium BC in Central Anatolia. In S. de Martino (ed), *Handbook Hittite Empire. Power Structure*s, De Gruyter, 159-204.

Schiemann, E. (1951). Emmer in Troja. Neubestimmungen aus den trojanischen Körnerfunden. *Berichte der Deutschen Botanischen Gesellschaft*, 64, 155–170.

Schiemann, E. (1953). Vitis im Neolithicum der Mark Brandenburg. *der Züchter*, 23(10), 318-327.

Schirmer, W. (1996). Der Göllüdağ im anatolischen Hochland und seine Bauanlagen aus dem 8. Jahrhundert v. Chr. *Fridericiana Zeitschrift der Universitat Karlsruhe*, 51, 9-26.

Schlichtherle, H. (1977). Vorlaufiger Bericht über die archäobotanischen Untersuchungen am Demircihüyük (Nordwestanatolien). *Istanbuler Mitteilungen*, 27/28, 45–53.

Schmitt, A. K., Danišík, M., Aydar, E., Şen, E., Ulusoy, İ., and Lovera, O. M. (2014). Identifying the volcanic eruption depicted in a neolithic painting at Çatalhöyük, Central Anatolia, Turkey. *PloS one*, 9(1), e84711.

Schoop, U. D. (2011). Hittite pottery: a summary. In: H. Genz and D. P. Mielke (eds), *Insights into Hittite History and Archaeology* (Colloquia Antiqua 2), Peeters, 241-273.

Schoop, U.-D., and Seeher, J. (2006). Absolute Chronologie in Boğazköy-Hattuša: Das Potential der Radiokarbondaten. In: D. P. Mielke, U. D. Schoop, and J. Seeher (eds), *Strukturierung und Datierung in der hethitischen Archäologie: Voraussetzungen, Probleme, neue Ansätze. Internationaler Workshop, Istanbul, 26.–27. November 2004* (BYZAS 4), Istanbul: Ege Yayınları, 53–75.

Schroedter, T.M., and Nelle, O. (2015). New insights into Mid-Holocene vegetation in the southern Marmara region: Charcoal from the Late Neolithic to Early Chalcolithic settlement site

Aktopraklık, northwestern T-urkey. *Quaternary International*, 366, 81–95.

Schweingruber, F. H. (1990). *Anatomy of European Woods*. Paul Haupt Berne and Stuttgart Publisher.

Seeher, J. (2000). Getreidelagerung in unterirdischen Großspeichern: Zur Method-e und ihrer Anwendung im 2. Jahrtausend v. Chr. am Beispiel der Befunde in Hattuša. *Studi Micenei ed Egeo-Anatolici*, 42(2), 261-301.

Seeher, J. (2001). Die Zerstörung der Stadt Hattusa. In: G. Wilhelm (ed), *Akten des IV. Internationalen Kongresses für Hethitologie, 4.–8. Oktober 1999* (Studien zu den Boğazköy-Texten 45), Harrassowitz, 623-34.

Seeher, J. (2006). Der althethitische Getreidesilokomplex. In: J. Seeher (ed.), *Ergebnisse der Grabungen an den Ostteichen und am mittleren Büyükkale-Nordwesthang in den Jahren 1996–2000* (Boğazköy-Berichte 8), von Zabern, 45-84.

Seeher, J. (2010). After tee Empire: observations on the Early Iron Age in central Anatolia. In: I. Singer (ed.), *Ipamati kistamati pari tumatimis. Luwian and Hittite Studies presented to J. David Hawkins on the Occasion of his 70th Birthda*y, Emery and Claire Yass publications in archaeology, 220-229.

Seeher, J. (2015). Hitit Krallarının Ambarları: Devlet Hazinesi ve Güç Kaynağı olarak Tahıl Depolama. *CollAn*, 14, 189-203.

Sekeryapan, C., Streurman, H. J., van der Plicht, J., Woldring, H., van der Veen, Y., and Boomer, I. (2020). Late Glacial to mid Holocene lacustrine ostracods from southern Anatolia, Turkey: A palaeoenvironmental study with pollen and stable isotopes. *Catena*, 188, 104437.

Sen, B., Topcu, S., Türkeş, M., Sen, B., and Warner, J. F. (2012). Projecting climate change, drought conditions and crop productivity in Turkey. *Climate Research*, 52, 175–191.

Şenkul, Ç, Doğan, M., Ören, A., Köse, A., Kulakoğlu, F., Eastwood, W. J., Doğan, U., and Elton, H. (2022). Genesis of the Beyşehir Occupation Phase: Understanding the Socio-Environmental Systems of Anatolia and Interactions from Kültepe-Kanesh and Paleoecological Records. In: C. H. Roosevelt and J. Haldon (eds), *Winds of Changes. Environment and Society in Anatolia*, Koç University Press, 107-140.

Şenkul, Ç., and Doğan, M. (2018). Fosil ve güncel polen analizleri ışığında Mucur Obruk Gölü çevresinin paleovejetasyon değişimleri. *Türk Coğrafya Dergisi*, (70), 19-28.

Şenkul, Ç., Gürboğa, Ş., Doğan, M., and Doğan, T. (2022). High-resolution geochemical (μXRF) and palynological analyses for climatic and environmental changes in lake sediments from Sultansazlığı Marsh (Central Anatolia) during the last 14.5 kyr. *Quaternary International*, 613, 24-38.

Şenkul, Ç., Memiş, T., Eastwood, W. J., and Doğan, U. (2018a). Mid-to late-Holocene paleovegetation change in vicinity of Lake Tuzla (Kayseri), Central Anatolia, Turkey. *Quaternary International*, 486, 98-106.

Şenkul, Ç., Ören, A., Doğan, U., and Eastwood, W. J. (2018). Late Holocene environmental changes in the vicinity of Kültepe (Kayseri), central Anatolia, Turkey. *Quaternary International*, 486, 107-115.

Seppä, H. (2013). Pollen analysis, principles. In: *The encyclopedia of quaternary science*, Elsevier, 794-804

Shay, J.M., Anderson, S.M., and Shay, C.T. (1982). Carbonized Seeds and Wood. In: G.F. Rapp, and J.A. Gofford (eds), *Troy: The Archaeological Geology*, Princeton University Press, 189-193.

Sherratt, S. (1998). "Sea Peoples" and the Economic Structure of the Late Second Millennium in the Eastern Mediterranean. In: S. Gitin, A. Mazar, and E. Stern (eds), *Mediterranean Peoples in Transition: Thirteenth to Early Tenth Centuries BCE, in Honor of Professor Trude Dothan*, Israel Exploration Society, 292-313.

Sherratt, S., and Sherratt, A. (1993). The Growth of the Mediterranean Economy in the Early First Millennium BC. *World Achaeology*, 24, 361-378.

Shimada, M., Itoh, T., Motooka, T., Watanabe, M., Shiraishi, T., Thapa, R., Lucas R. (2014). New global forest/non-forest maps from ALOS PALSAR data (2007–2010). *Remote Sensing of Environment*, 155, 13-31.

Shin, N., Marston, J. M., Luke, C., Roosevelt, C. H., and Riehl, S. (2021). Agricultural practices at Bronze Age Kaymakçı, western Anatolia. *Journal of Archaeological Science: Reports*, 36, 102800.

Shumilovskikh, L. S., Seeliger, M., Feuser, S., Novenko, E., Schlütz, F., Pint, A., et al. (2016). The harbour of Elaia: A palynological archive for human environmental interactions during the last 7500 years. *Quaternary Science Reviews*, 149, 167-187.

Silistreli, U. (1984). Pınarbaşı ve Köşk Höyükleri. *Kazi Sonunclari Toplantisi*, 5, 81-85.

Silistreli, U. (1991). 1989 Köşk Höyük Kazısı. *Kazı Sonuçları Toplantısı*, 12(1), 95-104.

Simon, Z. (2011). Hethitische Topoi in der hieroglyphen-luwischen Historiographie. Bemerkungen zur Frage der Kontinuität. In: M. Hutter and S. HutterBraunsar (eds), *Hethitische Literatur: Überlieferungsprozesse, Textstrukturen, Ausdrucksformen und Nachwirken. Akten des Symposiums vom 18. bis 20. Februar 2010 in Bonn* (AOAT 391), Ugarit-Verlag, 227–43.

Simonetta, A. M. (2007). The coinage of the Cappadocian Kings: A Revision and a Catalogue of the Simonetta Collection. *Parthica*, 9, 9-152.

Simonetta, B. (1961). Notes on the Coinage of the Cappadocian Kings. *The Numismatic Chronicle and Journal of the Royal Numismatic Society*, 1, 9-50.

Singer, I. (1984). The AGRIG in the Hittite texts. *Anatolian Studies*, 34, 7-127.

Singer, I. (1999). A political history of Ugarit." In: W. Watson and N. Wyatt (eds), *Handbook of Ugaritic Studies*, Brill, 603-733.

Singer, I. (2000). New evidence on the end of the Hittite Empire. In: E. Oren (ed), *The Sea Peoples and Their World: A Reassessment*, The University Museum, 21-33.

Singer, I. (2002). *Hittite Prayers* (Writings from the Ancient World 11). SBL Press

Singer, I. (2006). Great Kings of Tarhuntašša. *Studi Micenei ed Egeo-Anatolici*, 38, 63-71.

Singer, I. (2007). Who were the Kaška? *Phasis*, 10 (1), 166-181.

Slimak, L., Kuhn, S. L., Roche, H., Mouralis, D., Buitenhuis, H., Balkan-Atlı, N., et al. (2008). Kaletepe Deresi 3 (Turkey): Archaeological evidence for early human settlement in Central Anatolia. *Journal of Human Evolution*, 54(1), 99-111.

Smith, A. (2007). Plant Use at Çadir Höyük, Central Anatolia. *Anatolica*, 33, 169–184.

Smith, A., and Branting, S. (2014). Some Phrygian Plant and Insect Remains from Kerkenes Dağ, Central Anatolia (Turkey). *Ethnobiology Letters*, 5, 44–51.

Smith, A., Bagoyan, T., Gabrielyan, I., Pinhasi, R., and Gasparyan, B. (2014). Late Chalcolithic and Medieval Archaeobotanical Remains from Areni-1 (Birds' Cave), Armenia. In: B. Gasparyan, M. Arimura (eds), *Stone Age of Armenia. A Guide-book to the Stone Age Archaeology in the Republic of Armenia* (Monograph of the JSPS-Bilateral Joint Research Project), Center for Cultural Resource Studies, Kanazawa University, 233-260.

Smith, A., Proctor, L., Hart, T. C., and Stein, G. J. (2019). The burning issue of dung in archaeobotanical samples: a case-study integrating macro-botanical remains, dung spherulites, and phytoliths to assess sample origin and fuel use at Tell Zeidan, Syria. *Vegetation History and Archaeobotany*, 28, 229-246.

Smith, H., and Jones, G. (1990). Experiments on the effects of charring on cultivated grape seeds. *Journal of Archaeological Science*, 17(3), 317-327.

Smith, M. E. (2004). The archaeology of ancient state economies. *Annual Review of Anthropology*, 33, 73-102.

Smith, M. E., Henkel, T. W., and Rollins, J. A. (2015). How many fungi make sclerotia?. *Fungal Ecology*, 13, 211-220.

Sofou, A. (2005). Strabo and the Historical Geography of Cappadocia. *Mediterraneo Antico*, VII(2), 739-766.

Sollee, A.E., Mönninghoff, H., Kozal, E., Karakaya, D., Heim, J., and Gür, S. (2020). The Development of the Southeast Lower Town of Sirkeli Höyük. A Preliminary Assessment based on the 2013–2019 Campaigns. *Altorientalische Forschungen*, 47, 215–285.

Sönmez, K. F., Kömüscü, A. U., Erkan, A., and Turgu, E. (2005). An Analysis of Spatial and Temporal Dimension of Drought Vulnerability in Turkey Using the Standardized Precipitation Index. *Natural Hazards*, 35, 243-264.

Souček, V. (1959). Die hethitischen Feldertexte Soucek. *Archív Orientální*, 27(3), 379-395.

Souček, V. (1963). Randnotizen zu den hethitischen. Feldertexte. *Mitteilungen des Instituts für Orientforschung*, 8, 368-382,

Spengler, R. (2019). Dung burning in the archaeobotanical record of West Asia: where are we now? *Vegetation History and Archaeobotany*, 28(3), 215-217.

Spengler, R. N. (2015). Agriculture in the central Asian bronze age. *Journal of World Prehistory*, 28(3), 215-253.

Spengler, R. N., and Willcox, G. (2013) Archaeobotanical results from Sarazm, Tajikistan, an Early Bronze

Age Settlement on the edge: Agriculture and exchange. *Journal of environmental archaeology*, 18(3), 211–221.

Spengler, R. N., Maksudov, F., Bullion, E., Merkle, A., Hermes, T., and Frachetti, M. (2018). Arboreal crops on the medieval Silk Road: Archaeobotanical studies at Tashbulak. *PLOS ONE*, 13(9), e0204582.

Steadman, R. S., Hackley, L. D., Selover, S., Yıldırım, B., von Baeyer, M., Arbuckle, B. S., Robinson, R., and Smith, A. (2019). Early Lives: The Late Chalcolithic and Early Bronze Age at Çadır Höyük. Journal of Eastern Mediterranean Archaeology and Heritage Studies, 7 (3), 271-298.

Steadman, R.S., McMahon, G., Şerifoğlu, T. E., Cassis, M., Lauricella, A. J., Hackley, L. D., Selover, S., Yıldırım, B., Arbuckle, B. S., von Baeyer, M., Heffron, Y., Tardio, K., Adcock, S. E., Dinç, E., Özger, G., Selvi, B., Offutt, S., and Hartley, A. (2019). The 2017-2018 Seasons at Çadir Höyük on the North Central Plateau. *Anatolica*, 45, 77–119.

Steadman, S. (2011). Early Bronze Age on the Plateau. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia: (10,000-323 BCE)*, Oxford University Press.

Steadman, S. R., and McMahon, G. (2015). Recent Work (2013–2014) at Çadır Höyük on the North Central Anatolian Plateau. In: S. R. Steadman and G. McMahon (eds), *The Archaeology of Anatolia: Recent Discoveries (2011–2014) Volume I*, Cambridge Scholars Publishing, 69-97.

Steadman, S.R., McMahon, G., Arbuckle, B. S., von Baeyer, M., Smith, A., Yıldırım, B., Hackley, L. D., Selover, S., and Spagni, S. (2019). Stability and change at Çadır Höyük in central Anatolia: a case of Late Chalcolithic globalisation? *Anatolian Studies*, 69, 21–57.

Stein, G. (1994). Economy, ritual, and power in 'Ubaid Mesopotamia. In: G. Stein, and M. S. Rothman (eds), *Chiefdoms and early states in the Near East: the organizational dynamics of complexity*, Prehistory Press, 35-46.

Stein, G. (2012). The development of indigenous social complexity in Late Chalcolithic Upper Mesopotamia in the 5th-4th millennia BC – an initial assessment. *Origini*, XXXIV, 125-151

Stein, G. J., Bernbeck, R., Coursey, C., McMahon, A., Miller, N. F., Misir, A., Nicola, J., Pittman, H., Pollock, A., and Wright, H. (1996). Uruk Colonies and Anatolian Communities: An Interim Report on the 1992-1993 Excavations at Hacinebi, Turkey. *American Journal of Archaeology*, 100, 205.

Stein, G. J., Edens, C., Miller, N. F., Özbal, H., Pearce, J., and Pittman, H. (1996). Hacinebi, Turkey: preliminary report on the 1995 excavation. *Anatolica*, 22, 85–128.

Stevens, C. J., Shelach-Lavi, G., Zhang, H., Teng, M., and Fuller, D. Q. (2021). A model for the domestication of Panicum miliaceum (common, proso or broomcorn millet) in China. *Vegetation History and Archaeobotany*, 30(1), 21-33.

Stewart, R. B. (1976). Paleoethnobotanical Report: Çayönü 1972. *Economic Botany*, 30, 219-225.

Stika, H.-P. (1997). Pflanzenreste aus dem archäischen Milet. Vorbericht zur Kampagne 1992. *Archäologischer Anzeiger*, 2, 157–163.

Stika, H.-P. and Heiss, A. G. (2013). Plant Cultivation in the Bronze Age. In: H. Fokkens and A. Harding (eds), *The Oxford Handbook of the European Bronze Age,* Oxford University Press, 348-369.

Stirling, P. (1965). *Turkish Village*. Weidenfeld and Nicolson.

Stirn, M. A. (2013). *Are the Grains All-Alakh? An Archaeobotanical Exploration of Agricultural Practices and Transitions at Late Bronze Age Alalakh (Tell Atchana)*. (M.Sc. thesis). University of Sheffield.

Stock, F., Ehlers, L., Horejs, B., Knipping, M., Ladstätter, S., Seren, S., and Brückner, H. (2015). Neolithic settlement sites in Western Turkey—palaeogeographic studies at Çukuriçi Höyük and Arvalya Höyük. *Journal of Archaeological Science: Reports*, 4, 565-577.

Stockmans, F. (1957). Au sujet de la présence de la vigne en Belgique au cours des périodes historiques et préhistoriques. *Bulletin du Jardin botanique de l'Etat, Bruxelles/Bulletin van den Rijksplantentuin*, 495-501.

Stroud, E. (2016). *An archaeobotanical investigation into the Chalcolithic economy and social organisation of central Anatolia* (PhD dissertation). University of Oxford.

Stroud, E., Bogaard, A., Charles, M. (2021). A stable isotope and functional weed ecology investigation into Chalcolithic cultivation practices in Central Anatolia: Çatalhöyük, Çamlıbel Tarlası and Kuruçay. *Journal of Archaeological Science: Reports*, 38, 103010.

Struever, S. (1968). Flotation Techniques for the Recovery of Small-Scale Archaeological Remains. American Antiquity, 33(3), 353-362.

Strunk, A., Olsen, J., Sanei, H., Rudra, A., and Larsen, N. K. (2020). Improving the reliability of bulk sediment radiocarbon dating. *Quaternary Science Reviews*, 242, 106442.

Stummer, A. (1911). Zur Urgeschichte der Rebe und des Weinbaues. *Mitteilungen der Anthropologischen Gesellschaft in Wien*, 41, 283-296.

Sturm, T. (2009). allānū Haselnüsse als Delikatesse im kārum-zeitlichen Handel von Anatolien nach Nordmesopotamien (ca. 1930 1730 v. Chr.). *Altorientalische Forschungen*, 35(2), 296-311.

Süel, M. (2008). The sacred City of Hittites: sapinuwa. The new Excavations. In: A. d'Agostino, V. Orsi, and G. Torri (eds), Sacred Landscapes of Hittites and Luwians Proceedings of the International Conference in honour of Franca Pecchioli Daddi (Studia Asiana 9), Firenze University Press, 113-122.

Sugita, S. (1994). Pollen representation of vegetation in Quaternary sediments: theory and method in patchy vegetation. *Journal of Ecology*, 82(4), 881-897.

Sullivan, D. G. (1989). *Human-induced vegetation change in western Turkey: Pollen evidence from central Lydia* (PhD Dissertation). University of California, Berkeley.

Summer, G. (2008). Periodisation and Terminology in the Central Anatolian Iron Age. *Ancient Near Eastern Studies*, 42, 202-217.

Summers, G. D. (1994). Grey ware and the eastern limits of Phrygia. In: A. Tilingiroglu and D. H. French (eds), *Anatolian Iron Ages 3* (British Institute of Archaeology at Ankara Monograph 16), British Institute of Archaeology at Ankara, 241-252.

Summers, G. D. (1997). The identification of the Iron Age city on the Kerkenes Dag in Central Anatolia,. *Journal of Near Eastern Studies*, 56: 81–94.

Summers, G. D. (2013). East of the Halys: thoughts on settlement patterns and historical geography in the late and millennium and first half of the first millennium B.C. In: H. Bru, G. Labarre (eds), *L'Anatolie des peuples, des cités et des cultures (IIe millénaire av. J.-C. – Ve siècle ap. J.-C.). Colloque international de Besançon - 26-27 novembre 2010. Volume I.* Institut des Sciences et Techniques de l'Antiquité, 41-51.

Szczepanek, K., Myszkowska, D., Worobiec, E., Piotrowicz, K., Ziemianin, M., and Bielec-Bąkowska, Z. (2017). The long-range transport of Pinaceae pollen: an example in Kraków (southern Poland). *Aerobiologia*, 33(1), 109-125.

Tadmor, H. 1994. *The Inscriptions of Tiglath-Pileser III, King of Assyria*. Eisenbrauns.

Tadono, T., Ishida, H., Oda, F., Naito, S., Minakawa, K. and Iwamoto, H. (2014) Precise Global DEM Generation by ALOS PRISM, ISPRS. *Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences,* II, 71-76.

Tang, L., Lu, H., Song, J., Wangdue, S., Chen, X., Zhang, Z., et al. (2021). The transition to a barley-dominant cultivation system in Tibet: First millennium BC archaeobotanical evidence from Bangga. *Journal of Anthropological Archaeology*, 61, 101242.

Takaoğlu, T. (2005). *Ethnoarchaeological Investigations In Rural Anatolia*. Ege Yayınları.

Terral, J. F., Tabard, E., Bouby, L., Ivorra, S., Pastor, T., Figueiral, I., et al. (2010). Evolution and history of grapevine (Vitis vinifera) under domestication: new morphometric perspectives to understand seed domestication syndrome and reveal origins of ancient European cultivars. *Annals of* *botany*, 105(3), 443-455.

Tezcan, B. (1992). 1969 Göllüdağ Kazısı. *Türk Arkeoloji Dergisi*, 30, 1-30

Thery-Parisot, I., Chabal, L., and Chrzavzez, J. (2010). Anthracology and taphonomy, from wood gathering to charcoal analysis. A review of the taphonomical processes modifying anthracological assemblages in archaeological contexts. *Palaeogeography Palaeoclimatoly Palaeoecoly*, 291, 142–153.

Topak, R., and Acar, B. (2010). Konya Basin agriculture-environment relationships and sustainability. In: *Second International Symposium on Sustainable Development*, 8-9.

Torri, G. (2016). Landowners and Renters at Ḫattuša. In: K. Droß-Krüpe, S. Föllinger, K. Ruffing (eds), *Antike Wirtschaft und ihre kulturelle Prägung*, Harrassowitz Verlag, 37-46.

Trameri, A., and d'Alfonso, L. (2020). The 'Sacred City' of Kınık Höyük: Continuity and Change in Cappadocia (Turkey) between the Late Achaemenid and Late Hellenistic Periods. In: W. Held (ed.), *The Transition from the Achaemenid to the Hellenistic Period in the Levant, Cyprus, and Cilicia: Cultural Interruption or Continuity?* (Marburger Beiträge zur Archäologie Band 6), Eigenverlag des Archäologischen Seminars der Philipps-Universität, 65-82.

Traverse, A. (2007). *Paleopalynology*. Springer.

Tsivikis, C. and Foley, N. (2011). Amorium Kazilari 2009. *Kazi Sonunclari Toplantisi*, 32, 47-68.

Tunno, I., Zimmerman, S. H., Brown, T. A., and Hassel, C. A. (2021). An improved method for extracting, sorting and AMS dating of pollen concentrates from lake sediment. *Frontiers in Ecology and Evolution*, 9, 313.

Tuplin, C. (2004). Medes in Media, Mesopotamia, and Anatolia: empire, hegemony, domination or illusion? In: G. R. Tsetskhladze (ed), *Ancient West & East*, Brill, 223-251.

Turkes, M. (2003) Spatial and temporal variations in precipitation and aridity index series of Turkey. In: H. J. Nolle (ed), *Mediterranean Climate. Variability and Trends. Regional Climate Studies*. Springer, 181-213.

Turner, S., and Brown, T. (2004). Vitis pollen dispersal in and from organic vineyards. I. Pollen trap and soil pollen data. *Review of Palaeoboany and Palynology*, 129, 117-132.

Twiss, K.C., Bogaard, A., Charles, M., Henecke, J., Russell, N., Martin, L., and Jones, G. (2009). Plants and Animals Together: Interpreting Organic Remains from Building 52 at Çatalhöyük. *Current Anthropology*, 50, 885–895.

Ucchesu, M., Orrù, M., Grillo, O., Venora, G., Paglietti, G., Ardu, A., and Bacchetta, G. (2016). Predictive method for correct identification of archaeological charred grape seeds: support for advances in knowledge of grape domestication process. *PLoS One*, 11(2), e0149814.

Ucchesu, M., Orru, M., Grillo, O., Venora, G., Usai, A., Serreli, P. F., and Bacchetta, G. (2015). Earliest evidence of a primitive cultivar of Vitis vinifera L. during the Bronze Age in Sardinia (Italy). *Vegetation history and archaeobotany*, 24(5), 587-600.

Ulaş, B. (2017a). Küçükyalı: Istanbul'da Bir Bizans Manastırının Tarımsal Ekonomisi. *Arkeoloji Sanat*, 154, 192–195.

Ulaş, B. (2017b). Yumuktepe Kalkolitik Dönem XVI. Tabakası ve Arpa Tarımının Önemi. *Arkeoloji sanat*, 154, 160–163.

Ulaş, B. (2019a). Oymağaç-Nerik Arkeobotanik Araştırmaları. *Arkeometri Sonuçları Toplantısı*, 34, 131–148.

Ulaş, B. (2019b). The Paleobotanical remains from Yumuktepe Level XVI. Barley cultivation: the basis of the socio-cultural transformation. In: G. Palumbi, and I. Caneva (eds), *The Chalcolithic at Mersin-Yumuktepe: Level XVI Reconsidered*, Ege Yayinlari, 169-179.

Ulaş, B. (2019c). Re-interpreting the uses of hulled wheats in the neolithic period based on their cultivation in today's Northern Anatolia. In: A. V. Rossi (ed), *Archaeology of food new data from international missions in Africa and Asia. Proceedings of the 1st workshop on the archaeology of food Rome*, ISMEO, 213–230

Ulaş, B. (2020a). Archaeobotanical Research on Istanbul's Rural and Central Areas in the Byzantine Period. *Arkeoloji ve Sanat*, 164, 79-94.

Ulaş, B. (2020b). Reappraisal of the Neolithisation of the Marmara Region Through Archaeobotanical Analysis at Pendik Höyük and Yenikapı. *Arkeoloji ve Sanat*, 164, 27-40.

Ulaş, B. (2021). Traditional wheat cultivation in South-Eastern Anatolia and its comparison to the archaeological context. *Genetic Resources and Crop Evolution*, 68(1), 151-184.

Ulaş, B., and Fiorentino, G. (2010). Yumuktepe höyüğü yerleşmesi arkeobotanik analizlerinin ön sonuçlari. *Arkeoloji Sanat*, 135, 1–10.

Ulaş, B., and Fiorentino, G. (2021). Recent attestations of "new" glume wheat in Turkey: a reassessment of its role in the reconstruction of Neolithic agriculture. *Vegetation History and Archaeobotany*, 30(5), 685-701.

Ülgen, U. B., Franz, S. O., Biltekin, D., Çagatay, M. N., Roeser, P. A., Doner, L., and Thein, J. (2012). Climatic and environmental evolution of Lake Iznik (NW Turkey) over the last~ 4700 years. *Quaternary International*, 274, 88-101.

Ünal, A. (2015). Yeni bir Geç Hitit steli ve hiyeroglif yazıt. *Aktüel Arkeoloji*, 45, 54-57.

Üstünkaya, M. C. (2015). *Investigating climate related agricultural stress patterns at Bronze and Iron Age Kaman-Kalehöyük: the integration of botanical stable carbon and nitrogen isotope values, grain weight values, and seed analysis* (PhD Dissertation). University of Queensland.

Valamoti, S. M. (2013). Towards a distinction between digested and undigested glume bases in the archaeobotanical record from Neolithic northern Greece. A preliminary experimental investigation. *Environmental Archaeology*, 18(1), 31–42

Valamoti, S. M., and Charles, M. (2005). Distinguishing food from fodder through the study of charred plant remains: An experimental approach to dung-derived chaff. *Vegetation History and Archaeobotany*, 14(4), 528-533.

Valamoti, S. M., Gkatzogia, E., Hristova, I., and Marinova, E. (2018). Iron Age cultural interactions, plant subsistence and land use in southeastern Europe inferred from archaeobotanical evidence of Greece and Bulgaria. In: S. Gimatzidis, M. Pieniążek, S. Mangaloğlu-Votruba (eds), *Archaeology across Frontiers and Borderlands. Fragmentation and Connectivity in the North Aegean and the Central Balkans from the Bronze Age to the Iron Age* (OREA 9), Verlag der Österreichischen Akademie der Wissenschaften, 269-290.

Valamoti, S. M., Mangafa, M., Koukouli-Chrysanthaki, C., and Malamidou, D. (2007). Grape-pressings from northern Greece: the earliest wine in the Aegean?. *Antiquity*, 81(311), 54-61.

Valk, J. (2020). Crime and Punishment: Deportation in the Levant in the Age of Assyrian Hegemony. *Bulletin of the American Schools of Oriental Research*, 384(1), 77-103.

Van De Mieroop, M. (2009). *The Eastern Mediterranean in the Age of Ramesses II*. Wiley-Blackwell.

van den Hout, T. (2007). Some Observations on the Tablet Collection from Masat Hoyük. *Studi Micenei ed Egeo-Anatolici*, 49, 387–98.

van den Hout, T. (2010). The Hieroglyphic Luwian Signs L. 255 and 256 and Once Again Karatepe XI. In: I. Singer (ed), *Luwian and Hittite Studies Presented to J. David Hawkins on the Occasion of his 70th Birthday*, Emery and Claire Yass Publications in Archaeology, 234-243

van den Hout, T. (2020). *A History of Hittite Literacy. Writing and Reading in Late Bronze-Age Anatolia (1650–1200 BC)*. Cambridge University Press.

van der Knaap, W. O., van Leeuwen, J. F., Svitavská-Svobodová, H., Pidek, I. A., Kvavadze, E., Chichinadze, M., et al. (2010). Annual pollen traps reveal the complexity of climatic control on pollen productivity in Europe and the Caucasus. *Vegetation History and Archaeobotany*, 19(4), 285-307.

van der Veen, M. (2007). Formation processes of desiccated and carbonized plant remains – the identification of routine practice. *Journal of Archaeological Science*, 34(6): 968-990.

van der Veen, M. and Jones, G. (2006). A re-analysis of agricultural production and consumption: Implications for understanding the British Iron Age. *Vegetation History and Archaeobotany*, 15(3), 217-228.

van Loon, M. N. (1980). *Korucutepe: Final Report on the Excavations of the Universities of Chicago, California and Amsterdam in the Keban Reservoir, Eastern Anatolia, 1968-70*. Elsevier

van Peteghem, A. (2005). Recherche paléobotanique à Pessinonte: l'étude des grains et des fruits (2002-2003). *Anatolia Antiqua*, 13, 171–175.

van Peteghem, A. (2008). Résultats paléobotaniques et archéozoologiques de Pessinonte (Secteur Q). *Anatolia Antiqua*, 16, 147–152.

van Peteghem, A., and Braeckman, K. (2003). Pessinonte 2001, recherche paléobotanique: l'étude des grains et des fruits. *Anatolia Antiqua*, 11, 165–168.

van Zeist, W, Woldring, H., and Stapert, D. (1975). Late Quaternary vegetation and climate of the southwestern Turkey. *Paleohistoria*, 17, 53-143.

van Zeist, W. (1972). Paleobotanical Results of the 1970 Season at Çayönü, Turkey. *Helinium*, 12: 3-19.

van Zeist, W. (1979). Plant remains from Girikihaciyan, Turkey. *Anatolica*, 7,75–89.

van Zeist, W. (1998) *apud* Wright, H.T., and Whallon, R. (1998). Investigations at Fatmali-Kalecik: a Chalcolithic Hamlet in the Upper Euphrates Valley. In G. Arsebuk, M.J. Mellink, and W. Schirmer (eds), *Light on Top of the Black Hill. Studies Presented to Halet Çambel*, Ege Yayinlari, 775-809.

van Zeist, W. (2003). An Archaeobotanical Study of İkiztepe, Northern Turkey. In: M. Özdogan, H. Hauptmann, and N. Başgelen (eds), *From Villages to Towns. Studies Presented to Ufuk Esin*, Arkeoloji ve Sanat Publicatins, 547-581.

van Zeist, W., and Bakker-Heeres J. A. H. (1974). The Excavations at Korucutepe, Turkey, 1968-1970: Preliminary Report. Part X: The Plant Remains. *Journal of Near Eastern Studies*, 33, 113-115.

van Zeist, W., and Bakker-Heeres, J. A. H. (1975). Prehistoric and Early Historic Plant Husbandry, in the Altınova Plain, Southeastern Turkey. In: M.N. van Loon (ed.), *Korucutepe. Final Report on the Excavations of the Universities of Chicago, California* (*Los Angeles*) *and Amsterdam in the Keban Reservoir, Eastern Anatolia 1968-1970* (Studies in Ancient Civilizations), North-Holland Publishing Company, Amsterdam, 224-257.

van Zeist, W., and Buitenhuis, H. (1983). A palaeobotanical study of Neolithic Erbaba, Turkey. *Anatolica*, 10, 47–89.

van Zeist, W., and de Roller, G. J. (1992). The Plant Husbandry of Aceramic Çayönü, SE Turkey. *Palaeohistoria*, 33/34, 65–96.

van Zeist, W., and de Roller, G. J. (2003a). Some notes on the plant husbandry of Aşıklı Höyük, in W. van Zeist (ed), *Reports on Archaeobotanical Studies in the Old World*, Groningen, 115-142.

van Zeist, W., and de Roller, G. J. (2003b). The Çayönü archaeobotanical record. in W. van Zeist (ed), *Reports on Archaeobotanical Studies in the Old World*, Groningen, 143-166.

van Zeist, W., and Woldring, H. (1978). A postglacial pollen diagram from Lake Van in east Anatolia. *Review of Palaeobotany and Palynology*, 26, 249-276.

van Zeist, W., de Roller, G. J. (1995). Plant remains from Aşıklı Höyük, a pre-pottery Neolithic site in central Anatolia. *Vegetation History and Archaeobotany*, 4, 179–185.

van Zeist, W., Timmers, R. W., and Bottema, S. (1970). Studies of modern and Holocene pollen precipitation in southeastern Turkey. *Palaeohistoria*, 19-39.

van Zeist, W., Weterbolk-Van Rooijen, W., and Roodenberg, J. (1995). Floral remains from Late Neolithic Ilipinar. In: J. Roodenberg (ed), *The Ilipinar Excavations I: Five Seasons of Fieldwork in NW Anatolia 1987-91*, Peeters, 150–166.

Vandam, R., Kaptijn, E., Broothaerts, N., De Cupere, B., Marinova, E., Van Loo, M., Verstraeten, G., and Poblome, J. (2019). "Marginal" Landscapes: Human Activity, Vulnerability, and Resilience in the Western Taurus Mountains (Southwest Turkey). *Journal of Eastern Mediterranean Archaeology and Heritage Studies,* 7(4), 432-450.

Vanhaverbeke, H., Waelkens, M., Vyncke, K., De Laet, V., Aydal, S., Mušič, B., De Cupere, B., Poblome, J., Braekmans, D., Degryse, P., Marinova, E., Verstraeten, G., Van Neer, W., Šlapšak, B., Medarič, I., Ekinci, H. A., and Erbay, M. O. (2010). ‘Pisidian’ culture? The Classical-Hellenistic site at Düzen Tepe near Sagalassus (southwest Turkey). *Anatolian Studies*, 60, 105–128.

Veenhof 2017). Seven Debt-Notes of Anatolians from Ancient Kanesh. In: Y. Heffron, A. Stone, M. Worthington (eds), *At the Dawn of History: Ancient Near Eastern Studies in Honour of J. N. Postgate*, Penn State University Press, 665-684.

Vermoere, M. (2004). *Holocene Vegetation History in the Territory of Sagalassos* (*Southwest Turkey*). *A Palynological Approach* (Studies in Eastern Mediterranean Archaeology 6). Brepols.

Vermoere, M., Bottema, S., Vanhecke, L., Waelkens, M., Paulissen, E., and Smets, E. (2002). Palynological evidence for late-Holocene human occupation recorded in two wetlands in SW Turkey. *The Holocene*, 12(5), 569-584.

Vermoere, M., Smets, E., Waelkens, M., Vanhaverbeke, H., Librecht, I., Paulissen, E., and Vanhecke, L. (2000). Late Holocene environmental change and the record of human impact at Gravgaz near Sagalassos, Southwest Turkey. *Journal of Archaeological Science*, 27(7), 571-595.

Vernet, J.-L. (1973). *Etude sur l'histoire de la végétation du sud-est de la France au Quaternaire, d'après les charbons de bois principalement*. Université des sciences et techniques du Languedoc, Laboratoire de paléobotanique.

Vernet, J.-L., (1992). Les charbons de bois, les anciens ecosystemes et le role de l'homme. Actes du Colloque. *Bulletin de la Societe Botanique de France, Actualites Botaniques*, 139, 2-4

Verstraeten, G., De Laet, V., Dusar, B., D'Haen, K., Degryse, P., Neyt, B., Muchez, P., Dirx, K., Kaniewski, D., De Cupere, B., Van Neer, W., Thys, S., Udrescu, M., Marinova, E., Bakker, J., and Waelkens, M. (2011). The 2008 and 2009 Archaeometric Research at Sagalassos. *Arkeometri Sonuçları Toplantısı*, 26, 117–138.

Vignola, C., Balossi Rastelli, F., Masi, A., Sadori, L., and Siracusano, G. (2014). Investigating domestic economy at the beginning of the the Late Chalcolithic in Eastern Anatolia: the case of Arslantepe Period VIII. *Origini*, 36, 7–36.

Vignola, C., Masi, A., Balossi Restelli, F., Frangipane, M., Marzaioli, F., Passariello, I., Stellato, L., Terrasi, F., and Sadori, L. (2017). δ 13 C and δ 15 N from 14 C-AMS dated cereal grains reveal agricultural practices during 4300–2000 BC at Arslantepe (Turkey). *Review of Palaeobotany and Palynology*, 247, 164–174.

Vignola, C., Masi, A., Balossi Restelli, F., Frangipane, M., Marzaioli, F., Passariello, I., Rubino, M., Terrasi, F., and Sadori, L. (2018). δ 13 C values in archaeological 14 C-AMS dated charcoals: Assessing mid-Holocene climate fluctuations and human response from a high-resolution isotope record (Arslantepe, Turkey). *Rapid Communications in Mass Spectrometry*, 32(14), 1149–1162.

Virchow, R. (1879). *Beiträge zur Landeskunde in Troas*. Königl. Akad. der Wiss.

Voigt, M. (2003). Celts at Gordion. The Late Hellenistic settlement. *Expeditions*,45(1), 14-19.

Voigt, M. M., and Henrickson, R. C. (2000). Formation of the Phrygian State: The Early Iron Age at Gordion. *Anatolian Studies*, 50, 37-54.

von Baeyer, M. (2018). *Seeds of Complexity: An Archaeobotanical Study of Incipient Social Complexity at*

Late Chalcolithic Çadır Höyük, Turkey (PhD dissertation). University of Connecticut.

von Baeyer, M., Smith, A., Steadman, S. (2021). Expanding the plain: Using archaeobotany to examine adaptation to the 5.2 kya climate change event during the Anatolian Late Chalcolithic at Çadır Höyük. *Journal of Archaeological Science: Reports*, 36, 102806.

von der Osten, H. H. (1929). *Explorations in Hittite Asia Minor, 1927-1928* (Institute Communications 6). University of Chicago Press.

von der Osten, H. H. (1930). *Explorations In Hittite Asia Minor, 1929* (Institute Communications 8) University of Chicago Press.

von der Osten, H. H. (1937). *The Alishar Hüyük Seasons of 1930-1932, Part 1* (Oriental Institute Publications 28). The University of Chicago Press.

Von Post, L. (1918). Skogsträdpollen i sydsvenska torvmosselagerföljder. *Forhandlinger ved de*, 16, 433-465.

Waelkens, M. (1977). Phrygian votive and tombstones as sources of the social and economic life in Roman antiquity. *Ancient Society*, 8, 277-315.

Waelkens, M. (2004). The 2002 interdisciplinary and archaeometrical research at Sagalassos and its territory. *Arkeometri Sonuçları Toplantısı*, 19, 63–72.

Waelkens, M. (2005). The 2003 survey season at Sagalassos and in its territory. *Arkeometri Sonuçları Toplantısı*, 20, 173–186.

Waelkens, M., Mušič, B., Degryse, P., Dirix, K., Eekelers, K., Blomme, A., Marinova, E., De Cupere, B., van der Vijver, K., and Poblome J. (2014). Archaeometrical Research at Sagalassos in 2012. *Arkeometri Sonuçları Toplantısı*, 29, 128–140.

Waelkens, M., Mušič, B., Dirix, K., Muchez, P., Degryse, P., Marinova, E., De Cupere, B., Van Neer, W., Goffette, Q., and Theelen, J. (2013). The 2011 archaeometric research at Sagalassos. *Arkeometri Sonuçları Toplantısı*, 28, 177–190.

Waelkens, M., Mušič,, B., Corremans, M., Degryse, P., De Laet, V., Bakker, J., Dusar, B., D'Haen, K., Notebaert, B., Verstraeten, G., Marinova, E., van Neer, W., Goffette, Q., De Cupere, B., Baeten, J., and Devos, D. (2012). The 2010 ArchaeometrIc Research at Sagalassos. *Arkeometri Sonuçları Toplantısı*, 27, 305–329.

Walker, M., Head, M. J., Lowe, J., Berkelhammer, M., BjÖrck, S., Cheng, H., et al. (2019). Subdividing the Holocene Series/Epoch: formalization of stages/ages and subseries/subepochs, and designation of GSSPs and auxiliary stratotypes. *Journal of Quaternary Science*, 34(3), 173-186.

Wallace, M., and Charles, M. (2013). What goes in does not always come out: The impact of the ruminant digestive system of sheep on plant material, and its importance for the interpretation of dung-derived archaeobotanical assemblages. *Environmental Archaeology*, 18(1), 18-30.

Walsh, R. (2017). Experiments on the effects of charring on Setaria italica (foxtail millet). *Vegetation History and Archaeobotany*, 26, 447-453.

Ward, C. (2003). Pomegranates in eastern Mediterranean contexts during the Late Bronze Age. *World*

Archaeology, 34, 529–541.

Ward, C. (2004). Plant remains. In: G.F. Bass (ed), *Serçe Limanı: An Eleventh-Century Shipwreck*, Texas A & M University Press, 493-511.

Ward, W. A., and Joukowsky, M. S. (1992). *The Crisis Years: The 12th Century B.C. From beyond the Danube to the Tigris. Dubuque*. Kendall/Hunt.

Warnock, P., and Pendleton, M. (1991). The Wood of the Ulu Burun Diptych. *Anatolian Studies*, 41, 107–110.

Weeden, M. (2011). *Hittite Logograms and Hittite Scholarship* (Studien zu den Boğazköy-Texten 54). Harrassowitz.

Weeden, M. (2018). The Good God, the Wine-god and the Storm-god of the Vineyard. *Die Welt des Orients*, 48(2), 330-356.

Weiberg, E., and Finné, M. (2018). Resilience and persistence of ancient societies in the face of climate change: A case study from Late Bronze Age Peloponnese. *World Archaeology*, 50(4), 584-602.

Welton, L., Harrison, T., Batiuk, S., Ünlü, E., Janeway, B., Karakaya, D., Lipovitch, D., Lumb, D., and Roames, J. (2019). Shifting Networks and Community Identity at Tell Tayinat in the Iron I (ca. 12th to Mid-10th Century B.C.E.). *American Journal of Archaeology*, 123, 291–333.

Western, A. C. (1971). The ecological interpretation of ancient charcoals from Jericho. *Levant*, 3, 31-40.

White, C., and Miller, N. F. (2018). The Archaeobotany of Grape and Wine in Hittite Anatolia. *Die Welt* *des Orients*, 48(2), 249-284.

White, S. (2011). *The climate of rebellion in the early modern Ottoman Empire.* Cambridge University Press.

Wick, L., Lemcke, G., and Sturm, M. (2003). Evidence of Lateglacial and Holocene climatic change and human impact in eastern Anatolia: high-resolution pollen, charcoal, isotopic and geochemical records from the laminated sediments of Lake Van, Turkey. *The Holocene*, 13(5), 665-675.

Widell, M. (2012). Sumerian Agriculture and Land Management. In: H. E. Crawford (ed.). *The Sumerian World*, Routledge.

Wihelm, G. (2009). Demographic Data from Hittite Land Donation Tablets. In: F. Pecchioli Daddi, G. Torri, C. Corti (eds), *Central-North Anatolia in the Hittite Period. New Perspectives in Light of Recent Research* (Studia Asiana 5), Herder, 223-233.

Wilkinson, T. (1982). The Definition of Ancient Manured Zones by Means of Extensive Sherd-sampling Techniques. *Journal of Field Archaeology*, 9(3), 323–333.

Willcox, G. (1974). A History of Deforestation as Indicated by Charcoal Analysis of Four Sites in Eastern Anatolia. *Anatolian Studies*, 24, 117-133.

Willcox, G. (1991). Cafer Hôyük (Turquie): les charbons de bois néolithiques. *Cahiers de l'Euphrate*, 5–6, 139–150.

Willcox, G. (2002). Evidence for ancient forest cover and deforestation from charcoal analysis of ten archaeological sites on the Euphrates. In: S. Thiebault (ed.), *Charcoal Analysis: Methodological Approaches, Palaeoecological Results and Wood Uses*. British Archaeological Reports, 141–145.

Willcox, G. (2003). Les Macrorestes Vegetaux. In: B. Geyer, and J. Lefort (eds), *La Bithynie ai Moyen Age* (Realites Byzantines 9), Editions P. Lathielleux, 201-205.

Williams, D. (1973). Flotation at Siraf. *Antiquity*, 47, 288-292.

Williams, F. (1996). Xenophon's Dana and the Passage of Cyrus' Army over the Taurus Mountains. *Historia: Zeitschrift für Alte Geschichte*, (H. 3), 284-314.

Wittenberg, H., and Schachner, A. (2013). The ponds of Hattuša–early groundwater management in the Hittite kingdom. *Water Science and Technology: Water Supply*, 13(3), 692-698.

Wittfogel, K. A. (1957). Oriental Despotism: A Comparative Study of Total Power. Yale University Press.

Wittmack, L. (1880). Antike Samen aus Troja und Peru. *Monatsschrift des Vereines zur Beforderung des Gartenbaues in den königl. Preuss. Staaten und der Gesellschaft der Gartenfreunde Berlins* 23, 120-121.

Wittmack, L. (1888). Die Nutzpflanzen der alten Peruanes. *Congres International de Americanistes* 7, 325-49.

Wittmack, L. (1890). Samen aus den Ruinen von Hissarlik. *Zeitschrift für Ethnologie*, 22, 614-620

Wittmack, L. (1896). [untitled]. *Sitzungs-Bericht der Gesellschaft natürforschender Freunde zu Berlin* 3: 27–30.

Woldring, H., and Bottema, S. (2002). The vegetation history of East-Central Anatolia in relation to archaeology: the Eski Acıgöl pollen evidence compared with the Near Eastern environment. *Palaeohistoria*, 43/44, 1-34.

Woldring, R. and Cappers, H. (2001). The Origin of the 'Wild Orchards' of Central Anatolia. *Turkish Journal of Botany*, 25, 1-9.

Wood, T. S., and Baldwin, S. (1985). Fuelwood and charcoal use in developing countries. *Annual Review of Energy*, 10, 407-29

Woodbridge, J., Roberts, N., Palmisano, A., Bevan, A., Shennan, S., Fyfe, R. et al. (2019). Pollen-inferred regional vegetation patterns and demographic change in Southern Anatolia through the Holocene. *The Holocene*, 29(5), 728-741.

Wright, N. J. (2018). Examining dendrological features of oak as possible signals of systematic woodland management in the central Anatolian bronze and iron ages. *Quaternary International*, 463, 298-311.

Wright, N. J., Fairbairn, E., Üstünkaya, M. C., Faith, T. (2015). Explaining changing patterns of wood presence across the Bronze and Iron Age at Kaman-Kalehöyük, central Anatolia. *Quaternary International*, 431, 90-102.

Wright, N.J., Fairbairn, A.S., Faith, J.T., and Matsumura, K. (2015). Woodland modification in Bronze and Iron Age central Anatolia: an anthracological signature for the Hittite state? *Journal of Archaeological Science*, 55, 219–230.

Wright, N.J., Fairbairn, A.S., Üstünkaya, M.C., and Faith, J.T. (2017). Explaining changing patterns of wood presence across the Bronze and Iron Age at Kaman-Kalehöyük, central Anatolia. *Quaternary International*, 431, 90–102.

Wright, P. (2003). Preservation or destruction of plant remains by carbonization? *Journal of Archaeological Research*, 30(5), 577-583

Yakar, J. (2000). *Ethnoarchaeology of Anatolia: rural socio-economy in the Bronze and Iron Ages*. Monograph series of the Institute of Archaeology, Tel Aviv University.

Yakar, J. (2011). Anatolian Chronology and Terminology. In: G. McMahon and S. Steadman (eds), *The Oxford Handbook of Ancient Anatolia:* (*10,000-323 BCE*), Oxford University Press.

Yalçın, Ü. (1994). Milet'te bilimsel Araştirmalar. *Kazi Sonunclari Toplantisi*, 9, 153–161.

Yalçın, Ü. (1996). Milet'te bilimsel Araştirmalar 1994. *Kazi Sonunclari Toplantisi*, 11: 151–165.

Yaman, B. (2011). Anatomy of archaeological wood charcoals from Yenibademli mound (Imbros), western Turkey. *Mediterranean Archaeology and Archaeometry*, 11, 33–39.

Yaman, B. (2014). Kumru Tarlası (Zeviya Tivilki) Kızıl Meşe Kalıntıları. In: A. T. Ökse, A. Görmüş, E. Atay, and N. Erdoğan (eds), *Ilisu Baraji Inşaat Sahasi Kurtarma Projesi I: Demir Caği*, Mardin Müze Müdürlüğü, 268–269.

Yaman, B., Akyol, A.A., and Ayay, Ç. (2013). Daskyleion Kazısı Karbonize Ahşap Buluntuların Anatomik Teşhisi. *Arkeometri Sonuçları Toplantıları*, 29, 174–183.

Yaman, B., Akyol, A.A., and Erten, E. (2017). Olba Akropolisi Kuzey Kule Kazısından Ele Geçen. Karbonize Ahşap Malzemenin Anatomik Analizi. *Seleucia*, 7, 411–419.

Yaman, B., and Hüryilmaz, H. (2014). The identification of wood charcoals from an Early Bronze Age mound (Yenibademli) in western Turkey. *Drewno*, 193, 97–108.

Yener, A., Edens, C., Casana, J., Diebold, B., Ekstom, H., Loyet, M., and Özbal, R. (2000). Tell Kurdu Excavation 1999. *Anatolica*, 26, 31–117.

Yener, K. A. (2000). *The Domestication of Metals The Rise of Complex Metal Industries in Anatolia* (Culture and History of the Ancient Near East 4). Brill.

Yeniocak, M., Göktaş, O., Erdil, Y.Z., Özen, E., Alma, H.M. (2014). Investigating the use of vine pruning stalks (Vitis vinifera L. CV sultani) as raw material for particleboard manufacturing. *Wood research*, 59(1), 167-176.

Yıldırım, T. (2012). Resuloğlu 2012 Yılı Çalışmaları. *Çorum Kazı ve Araştırmalar Sempozyumu*, 3, 5–11.

Yilmaz, O., Erturk, Y. E., Coskun, F., Wilson, R. T., and Ertugrul, M. (2015). History of Sericulture in Turkey. *Asian Journal of Agriculture and Food Sciences*, 3(2), 237-242.

Zaharieva, M., Ayana, N. G., Hakimi, A. A., Misra, S. C., & Monneveux, P. (2010). Cultivated emmer wheat (Triticum dicoccon Schrank), an old crop with promising future: a review. Genetic resources and crop evolution, 57(6), 937-962.

Zeder, M. A., and Arter, S. R. (1994). Changing patterns of animal utilization at ancient Gordion.

Paléorient, 105-118.

Zimanski, P. E. (1985). *Ecology and Empire: the Structure of the Urartian State* (Studies in Ancient Oriental Civilizations 41). Chicago University Press.

Zipf, G. K. (1949). *Human behavior and the principle of least effort*. Addison-Wesley.

Zohary, D., Hopf, M., and Weiss, E. (2000). *Domestication of Plants in the Old World. The origin and spread of domesticated plants in Southwest Asia, Europe, and the Mediterranean Basin*. 4th edition. Oxford University Press.

Zohary, M. (1973). *Geobotanical Foundations of the Middle Eas*t. Fisher Verlag.